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ABSTRACT

This document comprises the proceedings of the 2001 conference of the Pacific Telecommunications Council. Papers are included on: implementation of e-commerce applications; use of corporate e-mail; socio-economic considerations in the adoption of new technologies; an innovation standard for telecommunications universal service; call center-based mobile commerce; application service providing; network operations support systems; Internet growth in Latin America; the AmericasPATH (AMPATH) network; Internet market opportunities in Latin America; information infrastructure in emerging nations; broadband information communications; commercial launch services; multimedia migration; interconnection in the Asia Pacific; the World Trade Organization Agreement and cost; Asian technology parks; services to entrepreneurs in the undersea cable industry; Internet commerce models in Asia; financing telecoms and Internet infrastructure build out in Asia; digital television in Mexico; mobile services in the Internet; submarine cable systems; Internet Corporation for Assigned Names and Numbers (ICANN); access and privacy concerns; Global Responsibility; Encrypted Coordinate; Operating System (GRECOS); telecommunications policy and practice; the digital divide and the distribution of wealth; African information economy; nonprofit organizations in the changing telecommunication world; global telecommunications problems; a private telecommunication operating foundation; pervasive computing; Wireless Application Protocol (WAP); mobile communication in China; satellites; Trans-Pacific High Data Rate (HDR) satellite communications experiments; licensing in Korea; telecommunications and information policies in India; the universal service challenge in the United States and Australia; calibrated regulation; interconnection of networks; next generation networks and services; Internet access and quality for Asia; distance learning for Chinese as a foreign language; Internet

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privacy; cultural heritage presentation system; flexible outsourcing for small and medium-sized enterprises in Japan; national optical network in China; Internet access services and e-commerce in South Korea; next generation wireless; improvement of channel element utilization; bringing the Internet protocol to mobile; the mobile satellite industry; information technology for education, governance, and e-commerce; sign language users and visual communications; access to digital resources; information technology leadership in South Asia; emergency telecommunications for disaster mitigation; stimulating the growth of the Internet in South Asia; carriers network infrastructure; voice quality in next generation networks; optical networking technologies; end-to-end quality of service; and access network for ubiquitous broadband. Lists of sponsors and attendees are included.(MES)

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Mahalo

Dear PTC2001 attendees,

This year's conference has proven to be an overwhelming success. We hope that you were able to leave Honolulu with greater knowledge of both the current status and the future of our dynamic industry, as well as with new business relationships to speed your advance into this rapidly changing world of telecommunications and information technology.

Attendance was as high as it's ever been, and a number of new features were added this year. There were more sessions and opportunities to interact with other delegates, a Planet PTC annex in the Tapa Tower, wireless laptop computer access to Planet PTC and the Internet, poster sessions, a spouse/guest program, PTC2001 Aloha shirts, and a PTC logo shop. In addition we introduced an online web site called Planet Aloha that contained dining, shopping, entertainment and other information about Hawaii.

The Executive Board and standing Committees met at the conclusion of PTC2001 to review the event and to discuss plans for the coming year. The 4-day event ended on 18 January 2001, marking the Pacific Telecommunications Council's 23rd successful, consecutive annual conference in Honolulu.

We would like to express our appreciation for the tremendous support from all of our sponsors, many of whom continue to support PTC year after year.

Also, a special thanks to our Board of Trustees, Executive Board, the Conference Committee, and other PTC members who worked all year together with the Secretariat to insure another successful event. By now you should have received instructions on how to access the entire set of PTC2001 proceedings from the PTC web site via the Internet. If you have not received these instructions, please contact us. We will also be sending shortly to registered attendees of the conference a notice on how a complimentary copy of the PTC2001 proceedings on CD rom may be obtained.

We hope you enjoyed PTC2001. We are already beginning our planning for PTC2002, and please be assured that we will be spending this year finding ways to improve the conference so that next year's will be the best ever.

Sincerely,

Hoyt H. Z

Hoyt H. Zia Executive Director

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Monday 15 January 2001 – Concurrent Sessions

	1100–1230	1400–1530
🧍	**M.1.1** Adoption of New Technologies	**M.2.1** Reducing Global Telecommunications Problems
💼	**M.1.2** Application Service Providers	**M.2.2** The End of the Line
🌎	**M.1.3** Latin America	**M.2.3** Explore Opportunities in China Telecom / Data Market (webcast)
@	**M.1.4** New Satellite Initiatives I (webcast)	**M.2.4** New Satellite Initiatives II
✓	**M.1.5** Interconnection Issues	**M.2.5** Regulatory Reform Processes
$	**M.1.6** Infrastructure Development	**M.2.6** IP/Next Generation Networks

Tuesday 16 January 2001 – Concurrent Sessions

	0900–1030	1100–1230	1430–1600
🚹	**T.1.1** Education and Use of New Technology	**T.2.1** Going Digital in Developing Countries	**T.3.1** Go into the Cultural Online Technology
💼	**T.1.2** Infrastructure	**T.2.2** Communications in the Pacific Rim, Five Years into the Future (webcast)	**T.3.2** Application Implications
🌐	**T.1.3** Satellite Systems		**T.3.3** Southeast Asia
@	**T.1.4** Wireless Communications (webcast)	**T.2.4** New Developments in Submarine Cable Technology	**T.3.4** Global Internetworking
✓	**T.1.5** Digital TV Regulation	**T.2.5** Internet and IT Governance	**T.3.5** What are the Risks and Rewards of B2B Commerce? (webcast)
$	**T.1.6** Wireless Development	**T.2.6** The Digital Divide: How Can Developing Nations Jointly Pursue Telecommunications and Internet Development	**T.3.6** Fiber Optic Cable Development

Wednesday 17 January 2001 – Concurrent Sessions

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	0830–1000	1030–1200
🚹	**W.1.1** Ethical, Legal and Other Socio-Cultural Issues Surrounding New Technology Emergence in the Pacific	**W.2.1** Overcoming Digital Divide
💼	**W.1.2** Distance Learning (webcast)	**W.2.2** EDU-COMMERCE–Where Education meets Commerce
🌎	**W.1.3** East Asia	**W.2.3** South Asia
@	**W.1.4** Enhancing Wireless	**W.2.4** Networking Technologies (webcast)
✓	**W.1.5** The Global Regulation of Mobile Satellite Systems: The Users' Plight, The Need for Truly Open Access and the Lessons to be Learned	**W.2.5** Commercial Launch Services Industry Panel
$	**W.1.6** Fear and Loathing in the Peering Process	**W.2.6** Data Networking

Program

Social / Cultural

Monday, 15 January 2001
1100–1230

M.1.1 Adoption of New Technologies

Chair: BARRY BROWN, Professor, College of Education, University of Saskatchewan, *Canada*

M.1.1.1 Stakeholder Considerations for Implementation of E-Commerce Applications: A Health Care Industry Case Study (*ABSTRACT*)

ELIZABETH MORE, Director, Macquarie Graduate School of Management and
G. MICHAEL MCGRATH, Deputy Director, JRCASE, Macquarie University, *Australia*

M.1.1.2 The Effective Use of Corporate Email (*ABSTRACT*)

SUPRIYA SINGH, Senior Research Fellow, CIRCIT, RMIT, *Australia*

M.1.1.3 Socio-Economic Considerations in the Adoption of New Technologies: A Cross Country Analysis (*ABSTRACT*)

FRANCIS PEREIRA, Research Fellow and ELIZABETH FIFE, Research Fellow, Center for Telecommunications Management, University of Southern California, *USA*

M.1.1.4 Innovative Public Policy: Calling for an Innovation Standard for Telecommunications Universal Service

JAY EDWIN GILLETTE, Professor, Information & Communication Sciences, Center for Information & Communication Sciences, *USA*

Stakeholder Considerations for Implementation of e-Commerce Applications: A Health Care Industry Case Study

Elizabeth More and G. Michael McGrath

Abstract

http://www.mq.edu.au

1. INTRODUCTION

In short, it is the dependence of firms on environmental actors (i.e. external stakeholders) for resources that gives those actors leverage over a firm (Frooman, 1999, 195).

The increasing global emphasis on the boundaryless organisation - both internal and external has thrown up enormous challenges for traditional management practices, attitudes, and to the very nature of organising itself. More than ever before, organisations are having to reinvent their strategies. One of the key results of such change is that "Increasingly organizations are moving beyond traditional stakeholder management techniques to partnering tactics that lead to the achievement of common goals (Harrison & St. John, 1996, 46)." Surprisingly little thought has been given to linking collaboration and stakeholder management until recently in the academic literature and, even less, to grounding such thinking and discussion in the pragmatic reality of partnership experiences in the business world. In this paper we take up the critical role played by stakeholder management and partnerships in the rich, complex and fast paced e-commerce world, drawing on lessons learnt in a health industry case study of Australia's first business-to-business Internet trading community, the Project Electronic Commerce and Communication for healthcare (PeCC). This case has significant regional implications given the competing initiatives by global players (e.g. Baxter Healthcare and the Pacific Commerce Exchange) and the increasing interest shown by Australia's nearby neighbours in the potential template offered by PeCC.

2. THE CONCEPT OF STAKEHOLDERS

Perhaps the most frequently used citation on stakeholders is that of Freeman (1984), a pioneer in the field who emphasised the strategic management of stakeholders and, whose definition (p.46) of a stakeholder as "any group or individual who can affect or is affected by the achievement of the organization's objectives" is still widely used.

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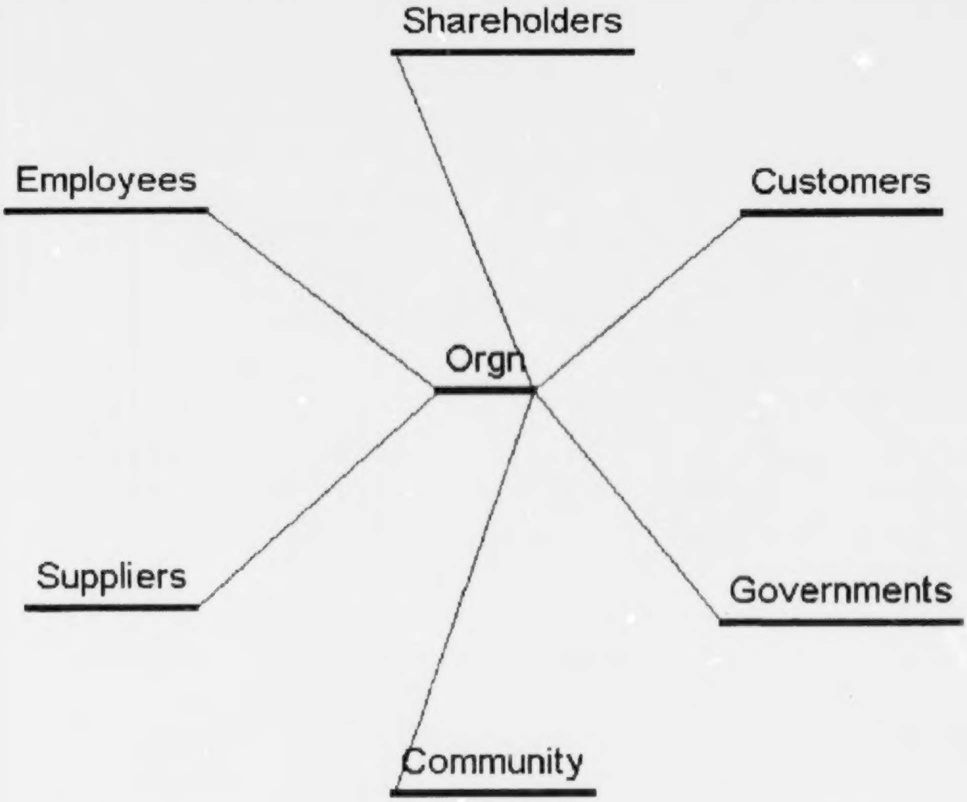

Figure 1: A view of major stakeholder types and their relationship with the organisation

Implicit in much discussion on stakeholders is that relationships with their organisations are as represented in the sociogram presented in Figure 1. This "spoke and wheel" type arrangement is misleadingly simple in a number of important respects. Specifically: groupings may overlap (e.g. an employee might also be a customer and a shareholder); stakeholder groupings may have relationships with each other, as well as with the organisation (e.g. Government-supplier and Government-employee); stakeholders are not all managed at one point within the organisation but, almost invariably, at several different organisation units, locations and levels; and, finally, stakeholders may be involved in many different types of relationships with the organisation and each other. This is a recipe for conflict.

While there are usually a myriad of arguments and rationales for stakeholder management, generally two groupings have been used as justification: the instrumental perspective that emphasises the end payoff to the organisation in terms of increased efficiency, profitability, flexibility, and the like; and the normative perspective that underlines a moral or philosophical foundation for managing stakeholder interests because it is morally appropriate so to do (Freeman, 1984; Harrison & St. John, 1996; Berman, Wicks, Kotha, & Jones, 1999).

Frooman (1999) suggests that managing stakeholders strategically involves asking who they are in terms of attributes; what they want in terms of their ends; and how are they going to attempt to gain their wants in terms of their means. He emphasises his view that (1999, 193) "stakeholder theory is about managing potential conflict stemming from divergent interests."

The amount of conflict critically relates to the strategic importance of specific stakeholders as does the nature of the stakeholder management techniques that should be used. As Harrison and St. John (1996, 51) put it: "Specifically, stakeholders who are strategically important should be managed as partners. Having established guidelines for determining the strategic importance of stakeholders, the next step in proactive stakeholder management is to engage in effective strategic partnering."

3. PARTNERING

Collaboration and partnering with competitors and suppliers are approaches organisations can adopt in order to best utilise existing interdependencies in the industry environment. Today, alliance management is fundamental to new business success.

Increasing environmental complexity and uncertainty foster a climate for such partnering, with organisations trying to ensure some predictability and control in an otherwise rather chaotic atmosphere. The new e-commerce world of today reveals just such an environment: "Like the railroad at the industrial dawn, e-commerce is 'totally new, totally unprecedented, totally unexpected' " (Peter Drucker quoted in Andrews, 1999, p. 66). The notion of partnering works well here because, unlike mergers with unified control, alliances have a structure for shared control (Gomes-Casseres, 1996), a crucial difference; they tend towards flexibility and breadth rather than narrowness; are much more ambiguous, dynamic and, often involve long-term relationships.

In the previous section, we drew attention to the complexity of stakeholder relationships *within* an individual organisation. This complexity is magnified in collaborative partnerships *between* organisations.

An alliance between two organisations is, perhaps, the most simple type of collaborative partnership, and a sociogram representing stakeholder relationships for alliances of this type is presented in Figure 2. All the relationship complexity associated with single organisations applies here as well but, in addition, alliance managers have to deal with customer, employee, shareholder and supplier groupings (sets) that are not mutually exclusive (i.e. individual parties within a group may deal with both organisations - as well as each other). Furthermore, as additional organisations join an alliance, the level of alliance management complexity has the potential to increase exponentially. In this respect, the direct link between the two organisations in Figure 2 is misleading, in that it seems to indicate that partnership management might be conducted along a single conduit (or, in Social Network Analysis terms, a *bridge* - Scott, 1991).

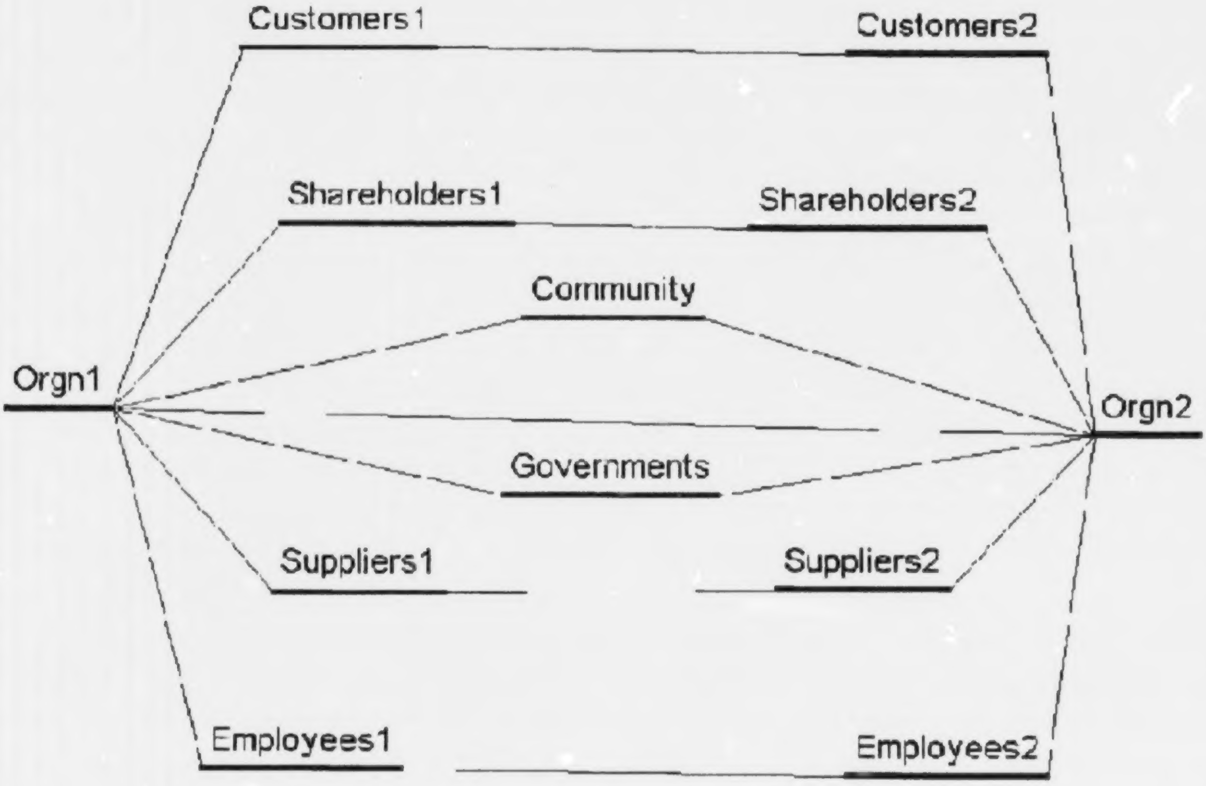

Figure 2: Stakeholder types and their relationships with two organisations in partnership (partial only).

The most challenging partnerships are those with competitors, often the most urgent and potentially the most productive. We shall now provide some background on a non-trivial partnership of exactly this type that illustrates how using a 'co-opetition' approach - competing and cooperating (Nalebutt and Brandenburger, 1997) is no simple matter.

4. PeCC: AUSTRALIA'S FIRST INTERNET TRADING COMMUNITY

4.1 Background

Initiated in 1996, PeCC emerged from Federal Government concern over burgeoning costs in Australia's $40 billion health sector and involved Commonwealth organisations working with industry. PeCC was developed to introduce e-commerce practices into the health sector with almost 700 suppliers, automating pharmaceutical and other supplies to hospitals and retail pharmacies. Supply chain communication is facilitated by an Internet-based platform, allowing more efficient interaction between the pharmaceutical and healthcare products industry's outlets (retail and hospital pharmacies), wholesalers, suppliers and manufacturers. Promoting and demonstrating e-commerce for the pharmaceutical industry supply chain, the project connects manufacturers, wholesalers, suppliers and hospitals. EAN (European Article Number) numbering of every consumable is critical and streamlining the supply chain relating to pharmaceuticals and other healthcare items supplied to hospitals is the basic focus of change in the project. Modelled on modern warehousing and retail systems such as databases, barcoding, and having suppliers and customers linked electronically, it is grounded in common numbering systems for products and in electronic distribution of orders by wholesalers and acknowledgment by manufacturers, using commonly available Internet-based software.

The pharmaceutical industry is one of the first Australian industry groups to have adopted a standardised approach to e-commerce. The project's impact, however, is significant within the broader healthcare industry, given the potential for all items in hospitals to be covered. When fully implemented, the major advantages arising from PeCC will be reduced waste in the health industry through improvements to supply chain management (SCM); better cost management (conservative estimates by DIST in 1998 of savings up to $340 million per annum) enabling improved overall patient healthcare delivery.

4.2 The Pharmaceutical Extranet Gateway (PEG)

The most successful of the PeCC projects is the setting up of *PEG (Pharmaceutical Extranet Gateway)*, now a major component of the overall project and a building block in establishing trading documents for the healthcare market. Figure 1 is a Netmap showing the complexity of linkages within the healthcare supply chain matrix and the positioning of PEG within the overall network.

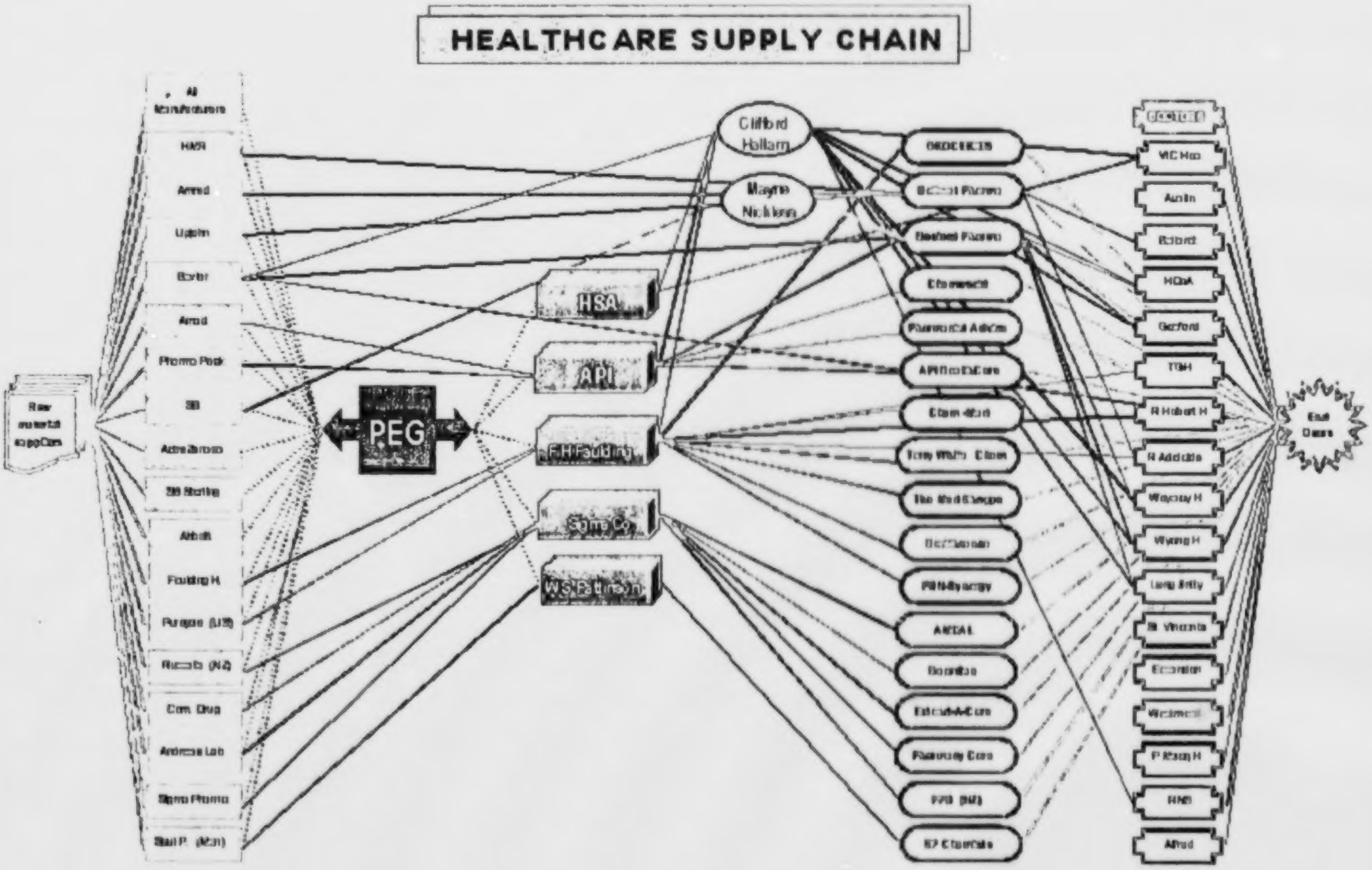

Fig. 3. Healthcare supply chain.

PEG's initial focus was to link five major competitive pharmaceutical wholesalers (Australian Pharmaceutical Industries, Faulding Healthcare, Hospital Supplies of Australia, Sigma Company, and W.H. Soul Pattinson & Co), and the 700 manufacturers from whom they purchase collaborating in developing a common Internet based EDI/EC platform, allowing them to trade electronically with their suppliers at reduced costs. The partnership has culminated in the five wholesalers using standard electronic order forms through PEG and expansion to include wholesale

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As illustrated in Figure 3, PEG provides a single common electronic ordering system that allows pharmaceutical wholesalers and suppliers to transact business through the Internet with the use of a common EAN-based bar coding or standardised numbering system. It enables wholesalers and suppliers to send purchase orders and to receive responses across the Internet rather than using the more expensive EDI option. Furthermore, it offers precision in processing; advanced delivery notification; streamlined payments; and accurate and timely shared business information. It provides a network linking the major wholesalers to manufacturers and suppliers for purchase orders, acknowledgments and payments. Ensuring secure encryption, documents can be tracked through the system. Analysts estimate that the cost of placing an order through the normal manual process would be around $50 to $70, and with full implementation of PEG, a reduced transaction cost of $2-5 per order.

5. STAKEHOLDER MANAGEMENT, MISMANAGEMENT, AND PARTNERING IN PECC

From Figure 3, it can be seen that a great many parties were involved in the PEG project. The parties most responsible for results achieved to date (and who will determine the ultimate success or failure of the project) are: the project champion; the project team (champion, Sterling Commerce and Datworks); the wholesalers (executive level); the wholesalers (PEG Steering Committee representatives); the wholesalers (IT implementation personnel); the suppliers; the retailers (hospitals and pharmacies); industry associations; and State and Federal governments (including their agencies).

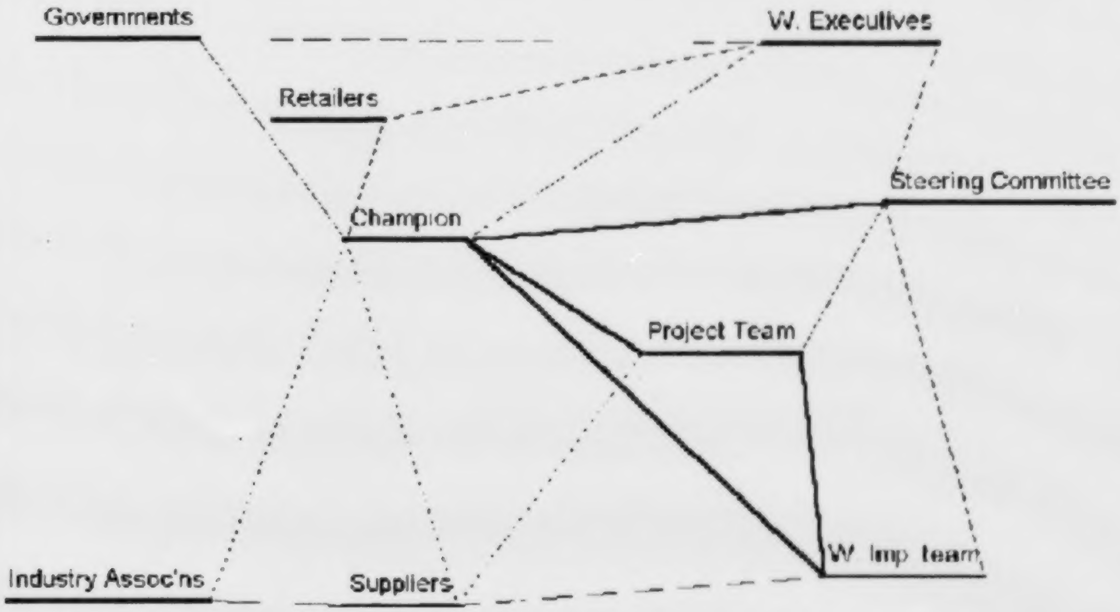

Figure 4: Map of major PEG stakeholder relationships.

A sociogram, representing broad level relationships between these major groupings, is presented in Figure 4. Essentially, lines between parties represent relationships encompassing an amalgam of inter-party communication, influence, trust and empathy (determined largely by attitudes towards the project itself). Relationship strength is represented by line width.

Savage, Nix, Whitehead, and Blair (1991) suggest a fourfold strategy for managing stakeholders according to type as follows:

(a) The supportive stakeholder who supports the organisation's goals and actions should be maximally involved to encourage cooperative potential;

(b) The marginal stakeholder who is not overly threatening or cooperative should be monitored;

(c) The nonsupportive stakeholder who is high on potential threat but low on potential cooperation must be managed through a defensive strategy;

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(d) The mixed blessing stakeholder is critical because of the equally high potential to threaten or cooperate and is probably best managed through collaboration.

In this case, the most supportive stakeholders were NOIE (a Federal Government agency) and the project manager/champion and his team, both of whom were maximally involved to ensure the widest possible success for the competitive collaboration occurring in PEG. The difficulty here is that links between these project champions and the Wholesaler Executives, Suppliers and (Supplier) Industry Associations (all critical stakeholders) were quite weak, thus illustrating dangers inherent in champions operating outside the "core" of an alliance. Marginal stakeholders included local government organisations, IT and health associations. While observed, these were not monitored in any real sense due to the project manager being under-resourced. Nonsupportive stakeholders included some government departments, retailers, industry associations, and some influential suppliers. Minor defensive strategy was involved here but, again, this was low level due to inadequate funding of the project overall. The mixed blessing stakeholders here were really the wholesalers themselves who were indeed engaged in a competitive collaboration venture.

Analysis of Figure 4 at a deeper level reveals additional difficulties, including:

- The centrality of the champion and the relative lack of linkages from the Project Team. In the euphoria of the decision making and early implementation this appeared unproblematic but difficulties with the chosen liaison personnel surfaced once the project had gained momentum.
- The weak linkage from the Project Team to Suppliers, with a failure in adequate persuasive communication, gave rise to current problems with signing the majority of suppliers up for the project.
- The weak link from the Champion to Industry Associations created a lack of adequate understanding and support for the project and resulted in conflict and competition in many cases.

Perhaps, however, the major problem facing the project was that, while executives had signed off on the project, there was then little in the way of follow-up support. Fundamentally, this was due to a lack of real appreciation of what the project is about - i.e. they persisted in regarding it simply as an IT-enabled cost-cutting exercise when they needed to see it as a central strategic issue for their businesses. In fact, failure to successfully implement PEG could threaten the continued existence of the wholesalers as major players in the Australasian pharmaceutical industry. Indeed, as intimated previously, recent e-commerce initiatives by the global players, Baxter Healthcare and the Pacific Commerce Exchange will enable hospitals in the region to bypass the existing wholesalers entirely and deal directly with suppliers!

We suspect this inability to appreciate the strategic implications, plus the threats and opportunities posed by new e-commerce technologies, is not confined to the pharmaceutical industry alone. As noted, PeCC (and PEG in particular) is effectively a template that might be adopted and utilised by any trading group. Now, more than ever, an organisation's ability to link its overall strategy, its business processes and its technology effectively will determine its fate. Our study does not encourage us that this is fully appreciated by senior decision makers (public and private sectors) within this region.

Finally, we conclude this analysis with the following observations:

- The initiation of any major e-commerce initiative necessitates detailed consideration of stakeholder identification, assessment of needs, interdependencies, strategic significance and management;
- Similarly, better understanding is required of the political dimensions involved in diverse stakeholders and their management - managing conflict and competition existing between governments, within and between government departments, between the public and private sectors, and within business communities and organisations themselves;
- Better management of cultural differences is required. This applies to both the macro level (e.g. management styles, concerns, and processes) and the micro level (e.g. cultural differences such as those between administrators, healthcare professionals, and IT personnel); and
- Not surprisingly, excellent communication between all stakeholders is a key critical success factor for any e-commerce initiative.

6. CONCLUSION

This paper has sought to unite stakeholder management and partnering in the e-commerce environment, emphasising the need for competence in both these activities individually as well as conjointly. It has outlined the evidence of problems with managing effective strategic partnering across a range of processes in order that better understanding of the issues be gained and that we prompt more attention to the area amongst practitioners and academics. It highlighted the way in which the instrumental stakeholder management approach turns upside down the neoclassical theory of the organisation.

So, while competitive collaboration is unquestionably problematic, it can produce many advantages, especially, as in this case, with government, associations, and the like, able to influence many organisations in a sector simultaneously. Yet without ongoing appropriate stakeholder management, such endeavours are bound to be less successful than otherwise anticipated. In many cases they may, indeed, ultimately fail.

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Back to top of page   Back to the sessions page

Professor Elizabeth More

Dr. Elizabeth More is Professor of Management and Director of the Graduate School of Management at Macquarie University and Director of MGSM Pty Ltd. She has a BA (1st Class Hons.) and Ph.D from the University of N.S.W. and a Graduate Diploma in Management from the University of Central Queensland. She has presented numerous conference papers and published widely, both locally and internationally, in the field of organisation studies, particularly in the areas of organisational communication, culture, change, communications technology and policy. She is a past President of the Australian Communication Association and, before entering academe, had wide experience working in the theatre, television, and advertising.

In addition to her academic work, Professor More has extensive experience in consulting to both private and public sector organisations (e.g. Royal Australian Navy, Royal North Shore Hospital, Anglican Retirement Villages, Commonwealth Bank, 3M, Australian Taxation Office, Hallas Trading Co., the Hilton Hotel, Zurich Insurance, and the Office of Public Management). She was also appointed by the Commonwealth Government in 1992 for a five-year term as a Member of the Government's Telecommunications Industry Development Authority (DIST) and was appointed to the Tax Concession Committee of the IR&D Board from 1996-98.

Among some of Professor More's recent monographs are the following: More, E. Managing Changes. Connecticut, U.S.A. (1998); More, E. and McGrath, M. Cooperative Corporate Strategies In Australia's Telecommunications Sector - The Nature Of Strategic Alliances. Canberra: DIST. (1996); Irwin, H. and More, E. 1994. Managing Corporate Communication. Sydney: Allen & Unwin Australia Ltd (1994); More, D. and More, E. 1994. "Technology and Health Care." in Green, L. and Guinery, R. eds. 1993. Social Implications Of Technological Change. Sydney: Allen & Unwin (in press); More, E. and Smith, K. ed. 1992. Case Studies in Australian Media Management. Sydney: AFTRS and MGSM; More, E. 1992. "Organisational Communication." in Hearn, G. ed. Organisation Behavior. Sydney: Harcourt Brace Jovanovich; Bordow, A. and More, E. 1991. Managing Organisational Communication. Melbourne: Longman Cheshire Pty. Ltd.; More, E. ed. 1990. TV 2000. Choices And Challenges. Sydney: Australian Broadcasting Tribunal; More, E. and Laird, R. 1985. Organisations In The Communications Age: An Introduction to Organisational Communication and Communications Technology for Management. Sydney: Pergamon Press Australia.

Back to proceeding page   **Back to the sessions page**

Dr. G. Michael McGrath

Dr. G. Michael McGrath gained his PhD in computing science from Macquarie University, Sydney, in 1993. He is currently Deputy Director of the CSIRO-Macquarie University Joint Research Centre for Advanced Systems Engineering (JRCASE), where he heads a research strand focusing on socio-technical aspects of systems and software engineering. He has over 20 years experience in the IT industry - mostly at Australia's largest PTC, Telstra, where he worked in a variety of technical and management positions. These included Senior Project Manager, responsible for the development of Telstra's multi-million dollar supply systems applications, and an executive-level position, as Manager Information Architecture within the organisation's Corporate Strategy Directorate. His current research interests include strategic information systems planning (SISP), business data and process modelling, knowledge base systems, software requirements elicitation, simulations of organisational decision making processes, and electronic commerce applications. He is the author of over 50 journal and conference publications and, in particular, is a regular supporter of and contributor to information systems conferences worldwide (where, in recent years, he has presented papers at the Americas, Australasian and European Conferences on Information Systems). Other recent publications have appeared in the Journals of Management Development, Communication Management and Intelligent Systems in Accounting, Finance and Management, as well as the Australian Computer Journal.

Back to proceeding page **Back to the sessions page**

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The Effective Use of Corporate E-mail

Supriya Singh

Abstract

1. Introduction [1]

E-mail is a fraught issue in many organizations. The speed, ease and reduced cost of sending e-mail have led to e-mail becoming an important way of communicating within large organizations. It is clear however that managing the volume of e-mail and its ability to transform the nature of work and communication will become a greater challenge as the use of e-mail in organizations increases. Ferris Research estimates that by 2002 staff "will spend more than four hours each day reading and answering an average of 50 work-related messages" (Zhou, 2000).

E-mail has already led to information overload and changes in the nature of organizational communication and work. A Morgan and Banks survey (2000) which asked Australian employees to rank the top stress factors in the workplace found that respondents ranked e-mail as the seventh most stressful part of their job — ahead of performance reviews, new technology and meetings.

International quantitative data on e-mail in organizations is surprisingly hard to find. Discussions of an increase in the volume of e-mail and its implications for productivity refer to the United States. It is also difficult to get comparative data on the proportion of employees in large organizations who use e-mail. In Australia 85 per cent of organizations with more than 100 employees had e-mail access in 1997-1998 (Australian Bureau of Statistics, 1999). There are no Australian Bureau of Statistics data on the percentage of employees in large organizations with e-mail access. The closest approximation is that 12 per cent (307,000) of the employees in organizations with 100 or more employees have Internet access. These data bring into doubt the assumption that all employees in large organizations everywhere have access to e-mail. The proportions will most likely be lower in countries with low Internet access.

Many organizations have formulated policies and guidelines for the use of e-mail. One of the important drivers is to protect the legal and commercial interests of the organization. Guidelines on e-mail etiquette are necessarily broad. Various models have been suggested. (See Allen and Bell, 1997, Electronic Communications at work, 2000; National Archives of Australia, Year unknown, Sherwood, 2000). The challenge for organizations is to reap the benefits of speedy and cheaper communication while ensuring that communication is effective.

In the second section, I detail the tensions behind the use of e-mail in a large organization - automative versus transformative characteristics and the technological/organizational perspective versus the users' perspective in a social context. In the third section, I describe the qualitative study of the use of e-mail in communicating with and between staff in an Australian university. In the fourth section I detail the issue of the increasing volume of e-mail to particularly illustrate the tension between the automative and transformative aspects of e-mail. In the fifth section, I trace the tensions between the technological/organizational perspective on the one hand and the users/social context perspective on the other in policies relating to the enhancement of the usability and functionality of e-mail. In the concluding section, I argue that organizational strategies need to deal with the transformative aspects of e-mail from the users' perspective.

2. E-mail tensions in a large organization

The key issues of e-mail use in a large organization arise from two kinds of tensions. The first tension is between the automative and transformative characteristics of e-mail. E-mail is a speedy, asynchronous communication channel that can be cost-effective and automate existing processes of business communication. But the speed and directness of e-mail, its ability to extend the conversation to a large number of participants, and the way e-mail can straddle written and spoken communication has the potential to transform the nature of communication and redefine work and roles in the organization.

This categorisation of the automative and transformative characteristics of e-mail builds on Zuboff's (1988) earlier distinction between the automating and informating effects of the computer on business processes. In her study of the introduction of the computer in a range of service and manufacturing organizations, she found that the computer not only automated business processes, but it "informated" business processes. The computer gave additional information about the processes which made possible a different way of doing business.

The second tension is between the technological and organizational perspective on the one hand and the users' perspective and social context on the other. The technological/organization perspective most often goes in tandem with an emphasis on the automative aspects of e-mail. In the technological and organizational perspective that is most common in organizations, e-mail is seen as an electronic messaging system. At times it is also seen as an "electronic post office" and an "electronic photocopying" system.

In the users' perspective, the user and his or her activities are placed at the centre of the questions. The questions and concepts then focus on the activity and nature of communication rather than the technologies and channels that are being used. Communication and the use of channels are studied within their social context.[2]

The social context of communication is particularly important, for ignoring that context produces "tunnel design" which leads to as many problems as it solves (Brown and Duguid, 2000). Rob Kling also advocates a social contextual inquiry which emphasizes the social context of information technology and use so as to understand the way technologies are socially shaped within the organization (Kling, 2000).

My approach to the users' perspective draws on the social theory of information which emphasises the 'sense-making' dimension of information, seeing information as a construct of the user (Dervin & Dewdney 1986). Markus (1994) and Ngwenyama and Lee (1997) have also highlighted the social context, arguing that the choice of media and its perception of 'richness' and 'leanness' are influenced by the social context and meanings ascribed to activities and channels.

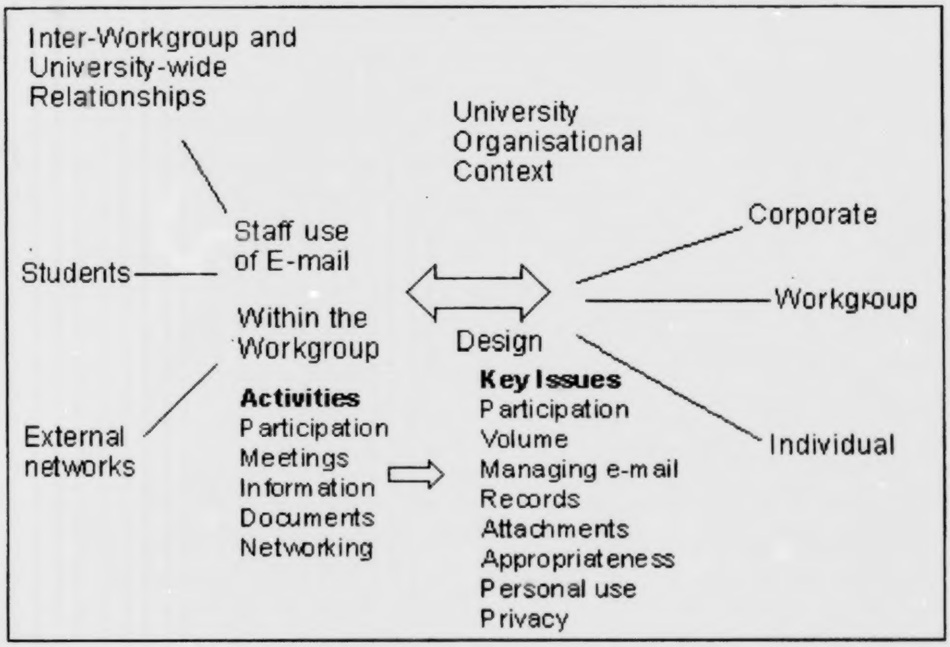
The difference in perspective changes the questions and issues that are seen as important and so changes the aims of strategy and policy. E-mail is seen as part of the way students and staff communicate, the way staff communicate with staff and with their external networks. So e-mail has to work for all these users in the context of their activities and audiences. The technological infrastructure, the design of the system has to be judged according to its use for teaching and learning, for research, for management and administration.

These two kinds of tensions are further examined in sections four and five.

3. A qualitative study of the use of e-mail

In this paper I draw on a qualitative study of the use of e-mail in a large Australian university. The focus is on the users of e-mail in the context of their activities and audiences. The approach is depicted in figure 1.

Figure 1: Approach to Designing for the Effective Use of E-mail at the University


Inter-Workgroup and University-wide Relationships
University Organisational Context
Corporate
Staff use of E-mail
Students
Workgroup
Within the Workgroup
Design
Key Issues
Participation
Volume
Managing e-mail
Records
Attachments
Appropriateness
Personal use
Privacy
Activities
Participation
Meetings
Information
Documents
Networking
External networks
Individual

The focus is on staff as the main user group. The University's main activity areas are teaching, research, management, administration and the provision of support services. These activities are addressed to different audiences — staff within the workgroup, staff throughout the University, students and external associates. These activity areas have many component activities in common, such as participating in meetings and discussions, transmitting and receiving information, sending, receiving and working on documents and networking.

3.1 A qualitative study

The qualitative study draws on open-ended interviews of the use of e-mail by 30 University staff with varying responsibilities and levels of computer expertise. The interview sample includes a selection of senior and middle level managers, staff primarily involved in teaching and research, administrative and support staff. In the sample are included staff across varied faculties, together with a deeper examination of the culture of a range of workgroups. The interview data were analysed using NUD*IST (Non-numerical Unstructured Data Indexing Searching and Theorising), a computer program for the analysis of qualitative data.[3]

This is a "grounded study" in that the data drive the emerging theory, rather than validate a pre-conceived design. Mid-way through the interviews, the research team conducted a workshop with 14 staff drawn from areas supplementing those covered in the interviews. We asked the workshop participants to comment on the interim understandings and point to additional areas of investigation This enabled wider consultation and helped bridge the study of use and design. Subsequent interviews — some with workshop participants —

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probed the design issues. Throughout the study, we also periodically consulted with members of our reference group which comprised senior and middle managers with relevant expertise on the use of e-mail.

4. Managing the volume of e-mail

In this section I detail the issue of the increasing volume of e-mail to particularly illustrate the tension between the automative and transformative aspects of e-mail. I also make clear the difference in approach from the technological and organizational perspective on the one hand and the users' perspective on the other. The main themes of this section are graphically depicted in figure 2.

E-mail is one of the principal channels of communication and is now integral to all activities of the university. The ease of e-mail communication has led to an increase in the volume of e-mail as it replaces to some extent the telephone, fax and snail mail. Staff in the university receive between 20 and 80 e-mail messages a day. The senior staff we interviewed reported 30-100, middle managers 15-80, administrative and support staff 10-20. Staff involved mainly in teaching receive 10-30. When subjects are being taught online, the emails can go up to 160 e-mails a day before student assignments are due.

It is more difficult to speak of the time taken to do e-mail. Some middle managers say that e-mail and its accompanying attachments take up 50 to 70 per cent of their working day. Other staff say that e-mail adds another hour to their workday. The difference in the evaluation of time taken on e-mail is partly because it is difficult to differentiate an activity from its communication dimension. A McKinsey study finds that though average Americans spend 51 per cent of their time in the office interacting, interaction "tends to go unmeasured and unmanaged" (Uren, 1998).

The ease of e-mail transmission has led to hopes of the reduced cost of communication. Ferris Research has estimated that the overall benefit in terms of increased productivity equals about $US 9,000 per employee. This includes time not spent on dealing with snail mail minus the extra time spent on non-productive e-mail. This survey however does not deal with the area of non-quantifiable costs and benefits such as decision making (E-mail productivity gains.., 2000). It must also be noted that the measurements have been about productivity rather than effectiveness.

Figure 2: E-mail characteristics and policy

Characteristics of e-mail	Perspectives and policy implications

Automative	**Technological and organizational perspectives**
Instant transmission Cheaper, particularly for overseas communication Asynchronous characteristics — saves time Cost effective compared to other communication channels for the sender	Buy and implement the most efficient messaging system Focus on efficiency, cost-effectiveness for the sender. At the centre of discussion is the increase in the use of e-mail and the substitution for the telephone, fax and snail mail and possibly meetings would be seen as leading to greater productivity
Transformative effects	**Users' perspective**
Increased volume of e-mail and time spent on communication during and after work hours Blurred boundaries between work and home Corporate memory and retention of records Work roles change E-mail straddles written and spoken communication Enables conversations between one and many, and many to many.	Management of e-mail with other Internet tools to ensure the effective use of e-mail Policy to facilitate discussion at the work group level Digital resources strategy Policy to facilitate discussion at the work group level to harness the transformative characteristics of e-mail. Important to ensure that users can judge the fit between communication channels, activities, audiences and social meaning. Focus on building a communication culture of dialogue and participation.

The tension in e-mail use is between the reduced cost and the effectiveness of communication. It is for this reason that despite the ease and cost-effectiveness of e-mail, it is not necessarily the preferred channel for all activities. E-mail is most effective for sending short, simple documents, interim communication between face-to-face meetings, question and answer exchanges, working on common documents and extending and enriching networks. Discussion groups and mailing lists enable discussion of specialist topics with a wider group than is possible through other communication channels. But face-to-face interaction continues to be the most important communication channel for developing policies and processes, solving problems and resolving conflict, developing a team approach, for conveying complex ideas and gaining incidental information that is important for understanding the context of work activities.

The stories of ineffective use highlight instances when the use of e-mail has not taken into account the fit between the activity, the audience and the social meanings of communication. Most often this happens when users have ignored the transformative characteristics of e-mail. The stories cluster around the following main issues:

- Changes in the nature of communication;
- The blurring of the boundaries between work and home; and
- The challenge of dealing with participative potential of e-mail.

4.1 Changes in the nature of communication

Some issues around e-mail within organizations centre around the characteristics of e-mail that differ from written, spoken and face-to-face communication. Has e-mail made for more mis-communication? Has e-mail led to poorer decision making? These issues relate to the recipient rather than the sender. Research on the use of e-mail in organizations has dealt mostly with the behaviour of the sender rather than the behaviour of the recipient (Williams, 1999).

Many staff glory in e-mail being short, direct, straddling written and spoken conversation. As Gillian, a senior executive says, it allows her "to cut to the chase". But Ramona, a manager who is relatively new to e-mail is becoming aware of some of the ways in which e-mail can lead to misunderstanding. She says,

> One of the biggest problems with e-mail — it's like writing anything — is that you know what you meant to say, you know the tone you meant to say it in.... but it may be received in a totally different way, because we haven't got the face-to-face [communication].

The directness of e-mail and its cost effectiveness needs to be weighed together with the needs of the recipient so that there is good decision making. Francis, a senior executive talks of how the immediacy and potential cost-effectiveness of e-mail, if not used properly, can disable an organization. He says,

> You have got a meeting at 4 o'clock so there is a belief that you can send paperwork up to half past three by e-mail because there is this notion that it is time and geography independent and therefore I have sent , my responsibility is over... So the notion of when people might read their e-mail or how they might engage in it, the notion that somebody might be off campus all day up to that 4 o'clock meeting doesn't feature into the originator's mind. The fact that it is sent means it is received.

E-mail cannot be managed in the same way as traditional communication channels. New ways of keeping track of communication need to be devised. The ability of e-mail to go direct to the person to whom it is addressed, has changed the role of personal assistants. One of the important roles of personal assistants was to channel, track and register in-coming and out-going communication. E-mail communication which goes directly to the senior executive and is wholly or partially dealt with by the senior executive, means that the personal assistant is not as easily able to track communication.

At a more abstract level, the organization needs to redefine the nature of corporate documents. What kind of e-mails are corporate documents? With e-mail being written but sometimes informal communication, traditional understandings related to retaining records need to be revisited. The wider issue here is to ensure that corporate knowledge is recorded in a way that is accessible and retrievable.

4.2 Blurred boundaries between work and home

The increased volume of e-mail combined with remote access is further blurring the boundaries between work and home. Working on e-mails at home is most characteristic of management staff with significant organizational responsibilities but no dedicated administrative assistance.

Abigail, who has significant managerial responsibilities at the faculty level, spends two hours some nights plus an hour before work in the morning to get through her 20-80 e-mails a day. She says, "I often get replies from people saying, 'It's 9 o'clock at night. What are you still doing at work?' In fact I'm at home" working."

Umberto one of the senior support personnel in the University says that during a particularly heavy period, he responded "to an awful lot of e-mails on Sunday afternoon because I didn't have time during the week... I did it for over two and half months."

The option to taking work home is to put in long hours at work. Ramona whose work is mainly management but with some teaching responsibilities, receives approximately 30 e-mails a day. She spends a couple of hours attending to the e-mails after 5.30 pm and yet it is frustrating "that at the end of the day you haven't been able to at least answer ten, 12 of them." She says, "A couple of months ago I was going through a stage here when I was working till 12 at least once a week. I try not to do it." Despite the long working hours, she e-mails from home too.

This blurring of boundaries between work and home influences staff perception of the use of university e-mail for personal use. Cyrus, a manager, says he provides his own PC and Internet Service Provider at home. So there should be no objection if he does some personal e-mail in the office. It is more a matter of principle, for most of his personal communication is on the phone. This redefinition means reconsidering "personal use" within the legal frameworks of the privacy of electronic communication.

There is thus a difference in the way staff talk of the privacy of e-mail communication and the University's policy. (See figure 3). The main aim of University policy is to articulate all the aspects of privacy and monitoring so that the organization is legally covered. Staff speak of privacy more in terms of recognising when e-mail should not be used for communicating a certain kind of information to a specific audience.

4.3 E-mail can lead to more participation and dialogue

The ability of e-mail to facilitate communication one-to-many and many-to-many has had the most transformative effect. E-mail is a different way of having a conversation, where the conversation itself becomes the major part of the activity and the organization (Levine et al, 2000).

For some management staff and all teaching and research staff, the mailing lists and discussion groups they have selected are essential parts of their network. They offer effective ways of getting information about specialist interests. There is an overlap at times between mailing lists and friendship networks.

There is a reasonable use of e-mail for two-way communication between students and teachers, between staff in some departments and between staff and some external networks. In some departments the use of e-mail to follow up issues raised in meetings has reduced the need for more meetings. However, at the level of the university as a whole, e-mail is mainly used for top-down communication. E-mail has not yet been significantly used for university-wide discussion about key issues and future directions, such as changes in teaching and learning, the continuing internationalisation of curriculum and the development of the university into an international university.

In order for e-mail to be used in a participatory way, there needs to be a culture of participation and dialogue. E-mail can be a catalyst for change, but in itself cannot produce the change. Cecez-Kecmanovic et al. (1999) of the University of Western Sydney, Hawkesbury, Australia, did an ethnographic study of a virtual discussion forum and organizational support system (OSS) based on e-mail and the Intranet in an Australian university in 1997. They found that its use was at first used for top down communication and the dissemination of documents "to support existing power structures and relations" (p. 25). At the group level, there were varied practices. Staff feedback was coordinated by the manager of the unit in some cases. In others, there was more open group communication that was summarised and sent to the OSS or individual representations. However as the University let go its control over policy documents and draft documents pertaining to the academic and research structure went on the Intranet, despite some scepticism of the process, "a real, deep, yet subtle change was slowly occurring" (p. 25). They say

> This change is about the control and ownership of the channels for knowledge communication and sharing. It has implications for the ways knowledge is created and accepted as valid organizational knowledge (by top Executive versus knowledgeable participants). These changes are potentially powerful in affecting the painful transition from a bureaucratic, authoritarian type of organization to a more democratic and participative one (p. 25).

5. Enhancing the Usability and Functionality of Corporate E-mail

The University has an e-mail system which provides a single corporate identity. The majority of our respondents were on the university e-mail system. A pared version of it is being rolled out for the 50,000 students.

There is a gap between the technical evaluation of the use of the e-mail system and users' perceptions of its usability and functionality. The technical evaluation of the e-mail system focuses on monitoring the number of e-mail accounts, the volume of external traffic, the "uptime" and monitoring the performance of the multi-gauge network. Another important issue is that of curtailing costs. Usability and functionality issues for users cluster around four main areas — access, reliability, compatibility and ease of use. This gap in evaluation can also be seen as a difference between *technological access* and *social access* (Kling, 2000). Technological access in this case would refer to the physical availability of computers, e-mail accounts, the networks at the corporate and the faculty levels. Social access on the other hand refers to the users' ability to use the system.

In figure 3, I summarise the difference in the two perspectives and the implications for strategy.

Figure 3: Policy Directions - Technological/Organizational vs Social/Users' Perspective

Technological/Organizational Perspective	Social Context/Users' Perspective

Electronic communications policy protects the organization's legal and commercial interests. Issues highlighted are: Privacy Personal use Inappropriate use	Electronic communications policy focuses on issues of use Issues highlighted are: Volume Participation Management of e-mail Retention of records Protocols of use
Enhancing the usability and functionality of e-mail — the focus is on monitoring system performance	Enhancing the usability and functionality of e-mail — the focus is on establishing a service charter and monitoring service standards for users
Access — Monitor the number of accounts. The focus is on *technological access.*	Monitor availability of computers, printers, e-mail and general Internet access in the university and remotely for staff and students. The focus is on *social access.*
Reliability — Monitor the "uptime" of system	Reliability — Monitor how often users can send messages when they want and that these messages are received.
Compatibility — Monitor compatibility within the organization, particularly for the standard hardware and software	Compatibility — Monitor compatibility within and outside the organization of a range of software and hardware through multiple ways of access
Ease of use — the best choice between available technologies	Ease of use — the functions which enable users to communicate more effectively

5.1 Access and availability

There is a difference between access and availability. From the technological perspective, access translates into the number of e-mail accounts and access to the e-mail network. For staff, access means the availability of e-mail for staff and students, at the University and remotely. The system at the corporate level may be working, but because of bottlenecks at the user end, or lack of computer and e-mail access and/or expertise, the user may not be able to access it.

At a time when teaching and learning most often involve an online component, demands of e-mail access have increased. However, as Yves, a manager long involved in learning and teaching says the selection of the e-mail system was made on its technological features rather than the needs of staff and students. "It was a decision that was taken based on scalability and storage rather than the needs of the users. ..."

5.2 Reliability

There is a gap between the evaluation of the reliability of the e-mail system at the corporate level and the way individual staff speak about it. This gap occurs because the technologists focus on monitoring the "uptime" of different aspects of the system, whereas staff evaluate the system's reliability for their communication.

Staff highlight the instances when the system does not work or the message is not received. Naomi a teacher says "Our system is often so hard to access and problematic that it's often safer to use snail mail...." Xena, a course co-ordinator and involved with teaching, says she had such a difficult time with an online student that finally she took to telephoning to say she had sent an email. Beatrice, an administrative assistant says when she sends e-mail to group lists she finds that some get the e-mail and some do not. It happens often enough that for agenda and minutes of meetings, she puts them in hard copy in the staff mailboxes.

Deborah, a personal assistant to a senior executive is also not confident that the e-mails she sends reach the recipients. She says she doesn't always get a notification that the e-mail has not been received. This is true particularly with external mail. Often she has to send another e-mail asking "Did you get it?" or call them. She says she met two people in a week who had not received the e-mail she had sent. "It really worries me. What about those other ones that I've sent?" she asks.

5.3 Compatibility

One of the strengths of e-mail as a communication channel is that it can make external communication time and cost effective. However, for external communication to be reliable, the University's e-mail systems have to be compatible with different hardware, software and points of access. The issue of compatibility arises at three different levels:

- Between the university and external e-mail systems
- Between the e-mail system on desktop computers and access to it from palmtop computers
- The use of different hardware and software within the university.

There is a particularly large gap in the evaluation of compatibility of the e-mail system for Mac computers. At the corporate level, the compatibility issue is seen as something temporary that will go when old Macs are replaced. For Mac users, particularly Mac users without advanced skills, the compatibility issue dominates all other aspects of e-mail use. There is a fear that a substantial percentage of e-mails sent from Macs are not received. The issue of compatibility comes to a head with attachments that sometimes do not open. It is a problem that is slowly getting better, but for most Mac users with average expertise, it is a source of great frustration.

6. Designing an effective e-mail system

The study of the use of e-mail in an Australian university shows that organizational strategies are likely to succeed if they take into account the transformative aspects of e-mail from the users' perspective. The major change at the corporate level is to supplement the technology and organization centred approach with a user centred perspective which takes into account the social context of communication.

The examination of the two issues of e-mail relating to volume and usability show that the failure to adopt this user centred perspective and address the transformative aspects of e-mail can be far-reaching.

As figures 2 and 3 show, depending on the perspective, different issues come to the centre of policy. When examining the volume of e-mail, the concern with reducing the costs of communication has to be complemented by a concern for effective communication. (See figure 2). For effective communication, one needs to address the ways e-mail is transforming the nature of communication. When these issues become prominent, then it becomes important to find ways of building a communication culture which promotes dialogue and participation. It also becomes important to address the changing nature of the document and its effect on corporate knowledge. The blurring of the boundaries between the home and office re-interprets the issue of personal e-mail and privacy. Initiatives at the corporate, work group and individual levels become essential so that there are shared understandings about appropriate channels of communication, patterns of access and response and e-mail etiquette.

An examination of usability and functionality issues shows the gap between the technological and users' perspective. The issues that are monitored are different. The technological perspective mainly focuses on measuring the performance of the technological aspects of e-mail. The users' perspective focuses on the access, reliability, compatibility and ease of use of e-mail. Hence the main recommendation is to supplement the system monitoring with a service charter and performance measures that are more user and activity centred.

Addressing the transformative aspects of e-mail from the users' perspective involves a change in organizational culture and the language of policy-making. But a failure to address these issues can prevent an organization from using the potential of the new communications technologies.

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End Notes

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[3] For a detailed examination of NUD*IST and the research process, see Singh, S. (1996). Money, Marriage and the Computer. Marriage and Family Review, Vol. 24 (3/4), pp. 369–398.

Back to top of page **Back to the sessions page**

Socio-Economic Considerations in the Adoption of New Technologies: A Cross-Country Analysis

Francis Pereira

Abstract

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INTRODUCTION

The advent of the digital age coupled with the accelerated development of transmission technologies has led to a proliferation of new devices and applications. Some of these applications, like on-line accounts payments and receipts, have increased business efficiencies. Others, such as telemedicine and tele-education have been shown to provide the economically disadvantaged with better access to health care and education. Yet others, such as cellular phones and other wireless devices have improved the life-styles of both residential and business users. Nonetheless, the adoption rates of these applications and devices have been extremely uneven in different countries. In Japan, for example, the adoption of wireless devices and applications, particularly those accessing the Internet, has been phenomenal, whereas in the United States, take-up has been relatively slow. Similarly, in Singapore, the move to a "paperless" society is more advanced than in other countries.

This paper examines the role of a "champion," social and cultural factors, and the effect of end-users in the of adoption of these new applications and technologies in Singapore, Hong Kong, Japan, Finland and the United States.

Role of the "Champion"

One of the most important factors driving the rate of adoption of new technologies is the presence of a "champion." The effect of the champion is most pronounced when it is a state or government. Where governments have taken a role, support has often been in terms of providing funds, land or infrastructure for Internet development. Taiwan, for example, has allocated some US$600 million to develop its Internet infrastructure and US$2.8 billion for a new hi-tech business park. Similarly, Hong Kong recently launched its Cyberport project. (New Straits Times: 7)

However, the role of the government is most pronounced in Singapore where its aggressive promotion and the deployment of new technologies is manifested in several initiatives. As early as 1994, it has been actively promoting the use of smart-card technology within several of the government ministries. The Ministry of Defence, for example, will have distributed smart-cards to all of its 300,000 military and civilian personnel by the end of 2000. The card will be used for a variety of purposes, including personal identification, authorization of physical access to facilities and logical access to network computer systems, meal purchases and expense reimbursements. Similarly, Singapore's Ministry of Home Affairs is coordinating a project that will see multi-function civil service cards put into the hands of some 60,000 employees working in all the government's ministries and departments. And in March 1998, as part of the IT2000 plan, Singapore launched its National Electronic Purse Program, designed to promote the use of smart cards (Burger: 34).

One of the Singapore government's first public initiatives was TradeNet, which allows companies to put their trade documentation online. TradeNet processes 99 per cent of all trade permit declarations, and is used by over 2,400 companies. Thus far, TradeNet has reduced the processing time from several days previously to five minutes. By 2001, the Singapore Trade Development Board (TDB) will have implemented an improved system that processes trade documents online. The new system, TradeNet Plus, will be a more complete and efficient solution than the current system, and will process online, certain trade functions that are now not covered by TradeNet, including trade insurance, trade finance and online payment. TradeNet Plus is expected to further reduce processing time to between one and three minutes. In addition, it is expected to generate annual savings of $ 2.8 billion when implemented in 2001 (Toh: 2)

The Singapore government's most ambitious project is its Singapore ONE (One Network for Everyone) programme, which is nearing completion. Singapore One is a high-speed optical fiber network and is the manifestation of the government's IT2000 master-plan, a blue-print to deploy IT in almost every government department designed to transform the state into an "intelligent island" (The Economist: 17). Its IT2000 master-plan also called for Singapore Cable Vision (SCV)[1] to connect all of Singapore's over 800,000 households to its S$500-million (US$350 million) hybrid-fibre co-axial network, irrespective of whether they intend to subscribe to the various services. SCV has a seven-year monopoly to provide cable television services which expires in 2002. (Cable and Satellite Asia: 18) The Singapore ONE initiative strives to develop a nationwide broadband network to link businesses, homes and schools, to deliver interactive, multimedia applications and services (Santiago: 2000).

The Singapore government's most recent initiative is to raise the percentage of small and medium-sized firms conducting e-commerce to twenty-five percent within three years' time. (Raj: 7). According to a survey conducted late in 1999 by the Singapore IT Federation, while 91 per cent of the top 1,000 companies already had Internet access, only 4 per cent of the 92,000 SMEs were conducting e-commerce (Raj: 7). Sixty-six per cent of SMEs with sales below $ 1 million cited lack of in-house IT skills and infrastructure, inadequate knowledge of e-commerce, and low budgets as barriers to implementing e-commerce. The Infocomm Development Authority of Singapore pegs the minimum cost for launching a simple e-initiative like putting up the company's website at some S$25,000 while web-sites offering full-fledged e-transactions could cost the firm $100,000 or more (Koh: 14). As such, the Economic Development Board (EDB) will assist businesses in their e-commerce strategy by supporting up to 50 per cent of their external consultants' costs in formulating a business plan or business collaboration venture, conducting feasibility studies, or providing assistance in implementation, up to a maximum limit of S$250,000[2] (Lee: 71). The government also unveiled a three-year, $11.7 million plan to prod the city's growing logistics industry into doing more with the Internet. Singapore's Trade Development Board and Infocomms Development Authority will work with logistics operators and technology vendors in implementing the plan, which covers such areas as developing e-commerce portals and inventory management. Singapore's transport and logistics industry contributed more than 7 percent to gross domestic product last year (Bangsberg:10).

Finally, Singapore's latest initiative is encapsulated by GeBIZ, an attempt to create a one-stop, round-the-clock centre for the government's business dealings The first phase was launched in April 2000[3], and the site is expected to be fully operational by the end of the year. GeBIZ enables the financial systems of ministries and the procurement applications to work together. Trading partners can find invitations to tender and purchase orders on the site. Suppliers can also submit invoices, check payment status, post their catalogues and bid for contracts. For the moment purchases are capped at S$30,000 (US$17,341), but the Ministry of Finance estimates that once new payment and security systems are introduced, 80% of all government procurement will transfer to GeBIZ. As with other online B2B trading networks, the benefits come in the form of more competitive bidding, easy access to suppliers round the world, time saved by online processing of orders, lower stocks and automated collection of high-quality data (The Economist: 17).

In 1999, in a similar initiative, the Singapore government launched eCitizen Center, an integrated service delivery designed to ensure that the public sector operated, and was seen to operate, as a single entity. This particular project is aimed at bringing together useful services and delivering them to Singaporeans in convenient and easily accessible packages. The Singapore government hopes that eCitizen will enhance the ability of the public to be increasingly familiar and comfortable with IT, which has become a critical component in the knowledge economy. The user interface the Singaporeans have chosen adopts the metaphor of a citizen journeying through life. (The Economist: 17).

However, governments aside, individuals who are champions also have a substantial effect on the adoption of new technologies. This is perhaps best illustrated in the case of telemedicine in the United States. Specifically the heath care industry in the United States has been experiencing substantial and ever-increasing cost pressures. While telemedicine offers significant potential for addressing some of the challenges faced by the health care industry and despite the fact that telemedicine technology has existed since the 1920s, the use of telemedicine has not been widespread. In general, telemedicine's ability to provide greater and more extensive health-care at lower costs[4] is being hampered by several social constraints, including low compatibility with existing medical practices, complexity of telemedicine equipment and interfaces[5], the absence of reimbursement by third party agencies, and incompatibility of state laws regarding telemedicine and licensure issues. However, one of the most important factors accounting for the deployment of telemedicine projects, or the lack thereof has been the presence of a champion. Interviews with telemedicine directors have found that those leading such projects tended to be charismatic entrepreneurs, articulate, enthusiastic, energetic, self-sacrificing, obsessed with their users, impatient for change and true believers in their cause. Furthermore, physicians who were most likely to use telemedicine were described as being:

"inquisitive, confident enough to ask questions and not be intimidated by specialists, and humble enough to believe that they did not know all the answers. They demonstrated qualities of lifelong learning, often used many sources for information, were often outgoing, preferring personal contact for consultants, and were ...often information influentials who conducted telemedicine consultations and often went on to educate other local colleagues about the outcomes of the consultations. Those consulting specialists who provided telecommunication services were characterized as being opinion leaders in their fields, experienced, providing a high standard of care, being flexible and adaptable and as being altruistic" (Williams and Moore, 1995).

Furthermore, although, the social system surrounding the adoption of telemedicine is very structured and complex, the lack of a clear position on telemedicine, in general, by a "national champion," such as the American Medical Association and most medical colleges and medical schools, save the American College of Radiology, presents another impediment. This lack of clear positioning and ambivalence has contributed, in part, to four major social impediments to the increased use of telemedicine.

In the first instance, the cost of implementing a telemedicine infrastructure is a large impediment. Currently, a large majority of telemedicine initiatives are sponsored by organizations where reimbursement is not crucial, like research centers, the Armed Forces or State-owned hospitals, since these are frequently financed by demonstration grants. Only an extremely small number of for-profit medical centers are involved in telemedicine and many of these, like the Mayo Clinic, are employing closed telemedicine systems (Tangalos, 1994). Furthermore, medical organizations are reluctant to purchase equipment because of the risk that it will be quickly outdated. New legislation shows promise in overcoming the payment issue of telemedicine. In January 1999, the U.S. Health Care Financing Administration issued guidelines on the reimbursement of tele-consultations, though significant restrictions apply. Also Medicare guidelines now call for reimbursement for telemedicine services that are deemed initial in nature: not exceeding two consultations. (Muirhead et. al.: 96). Payment still does not include reimbursement for telephone line charges or facility fees (Charles: 66). However, this is a positive step forward that could pave the way for expanded reimbursement for telemedicine services.[6] Until now, Medicare routinely paid only for radiologists to read images via store-and-forward telemedicine.

Secondly, under the present individual state licensure system the potential of telemedicine is limited to the somewhat arbitrary borders of a state, thus limiting geographic reach. Physicians are required to have medical licenses in each state in which they practice (Charles: 66). Thirdly, "there is significant uncertainty regarding whether malpractice insurance policies cover services provided by telemedicine" (Western Governor's Association, 1995). The legal problems associated with telemedicine malpractice liability are especially intricate when services crosses state borders. Liability is a significant problem for doctors as shown in a survey by the Washingtonian magazine which concluded that seventy-eight percent of physicians are engaged in practicing "defensive medicine"[7] with the result that malpractice liability premiums increased at an average annual rate of some twenty-two percent during the 1980s (Wasley, 92).>

Finally, like other communications technologies, there is a concern regarding the security of personal medical information stored in telemedicine systems. Sanders (94) notes the possible use of encrypting algorithms and legal precedent (yet to be defined) determining "reasonable and customary" efforts in protecting individual's information. In sum, it is clear that significant non-technological barriers exist to the more widespread adoption of telemedicine in the United States, including regulatory, cultural and cost issues. Such barriers may be assailable by the presence of a champion.

Role of Social and Cultural Factors

While the role of a champion is important, social and cultural factors may be equally important in explaining the varying rates of adoption of new technologies in different countries. Finland's high adoption rate of new technologies - it has the highest penetration of cellular phones, Internet access and electronic banking - has been attributed to everything from its education system, to its homogeneous population, to the infrastructure upgrades in shipping made decades ago to facilitate war reparations to Russia (Diamond: 134). The significance of social and cultural factors also accounts for the success of i-mode, an internet-enabled phone service from NTT DoCoMo, the mobile phone division majority-owned by national carrier NTT in Japan. Since its launch in February 1999, the i-mode has attracted 10 million subscribers. As such, it has become the biggest internet provider in Japan and is responsible for turning the web into a source of information that Japanese can access from their pockets.

The importance of these social and cultural factors is made more stark when juxtaposed with the United Kingdom: after nine months of availability, WAP (Wireless Application Protocol) phones have been bought by some 300,000 people, or only one percent of all mobile subscribers in the United Kingdom. In Japan, however, i-mode is currently attracting some 500,000 new subscribers monthly, and is expected to reach 17 million by the end of 2000 (Kelleher: 59).

One of the major reasons behind i-mode's success is that it complements the lifestyle of young urban Japanese consumers. Thirty-five percent of i-mode users are less than 25 years old and seventy percent are less than 35 years old. This is because, as is the case in most countries, young people tend to place greater importance on "reach" and lower importance on "richness" of information. Younger people tend to be more mobile than older people, generally spending more time away from home and the office compared to older people, and also tend to use public transportation more than their older colleagues (Funk: 5). i-mode is hugely popular in densely populated cities like Tokyo where waiting in lines, frequent traffic jams and general delays are commonplace. Mobile access to entertainment sites, news, weather, and local information helps make their chaotic cities negotiable. Not surprisingly, some fifty-five percent of i-mode accesses in the first few months of 2000 were to entertainment related areas, with the most popular entertainment categories being downloading of ringing melodies, playing games, the downloading of characters and other pictures, horoscopes and information about music (Funk: 7). Perhaps more importantly, instant messaging gives the ability to change meeting times and places as circumstances require. Although long commuting times provide an opportunity to check news, sports results, horoscopes and stock prices, i-mode phones can also be used for e-mails, paying bills and reserving concert tickets and flights. The phenomenal success of the i-mode phone is in large part due to its perception as the "hip" accessory of the moment by Japan's somewhat unique youth culture. The i-mode is considered stylish and sleek (some weigh less than three ounces), and additionally, they can be customized. Pop melodies can be downloaded to replace ringing and for an extra charge, animated characters will appear live on a customer's screen and can be sent off to friends. Playing games is another highly popular activity on the I-mode. Recently, Sony announced plans to develop games for NTT mobile phones, promising a more sophisticated future for mobile gaming (Collins: 26).

A significant factor behind the i-mode's success has been the relative rarity of home computers in Japan. Despite Japan's image as techno-friendly, in fact, the number of households with internet access only passed one in five this year - one of the lowest rates among industrialized countries. Thus, the i-mode provides a cheap alternative to accessing the Internet for Japanese consumers, providing information and services calibrated to the specific needs and culture of the society. Overall, it is not clear to what extent the success of i-mode is transferable to other markets with different cultural, geographic, and societal influences. However, early reports indicate that in Mexico, a country with one of the fastest growing internet markets in the world and where computer penetration is less than 3% of households, wireless penetration is expected to outnumber the country's 11 million fixed lines by the end of 2000, and is expected to reach some 30 million by 2003 (Mandel-Campbell: 18). Similar phenomenal growth rates in cellular telephony are being witnessed in the Philippines where it is also reported that some 40 million short messages (SMS) are sent daily, making it the "SMS capital of the world" (Business World, Philippines).

Role of End-User Value

The challenges faced by Cable and Wireless HKT (fomerly HongKong Telecommunications) in deploying its multimedia services best illustrates the "sovereign" role of the end-user, despite beneficial social, cultural and economic factors. Cable and Wireless HKT IMS had been working on developing its VOD system since 1995 and, at a cost of some HK$1.3 billion, finally launched commercial services of its interactive multimedia service, iTV, on March 25, 1998. At the launch, there were expectations for some 200,000 –300,000 subscribers within the next few years. It was reported that there were 50,000 subscribers within the first month. However, the service has only 88,000 to 100,000 subscribers. Besides its VOD service, IMS is offering music on demand, news, home shopping, with discounted prices, racing on demand, karaoke on demand, home banking and high-speed internet access. The low acceptance rate is surprising given the fact that several key socio-economic factors would have augured its success: First, the relatively high disposable income, general affluence of Hong Kong residents, as well as their willingness to try new technologies, all bode well for the acceptance of VOD in Hong Kong. Secondly, unlike the United States with a cable penetration rate of 60 to 70 percent, the cable market in Hong Kong is dominated by a monopoly service provider, Wharf Cable and the cable penetration rate is only about 20 percent. Thirdly, Hong Kong's fully digitized telephone network, argued for an initial high penetration rate for VOD. Finally, the dearth of broadcast television channels in Hong Kong, as well as a limited number of channels available through Star TV, resulting in a very limited fare of product offerings, should have worked in favor of the successful deployment of iTV.

Even in Singapore, despite the government's major push, the Singapore One project is facing difficulties. The launch of the pilot Singapore ONE network and services is seen here as a major step forward. But the network failed to reach government projections of 400,000 households by 2000: only 12,000 subscribers had signed up by the end of the first year. An official close to the implementation of the government's infrastructure plan called the initial goal "an almost unachievable task" (Santiago: 2000). Singapore has spent some S$ 340 million over the past few years wiring every home, school and office to a super high-speed internet service. Yet, in spite of impressive statistics showing six out of every 10 homes in Singapore have personal computers and one in two has access to the internet, only 14 per cent of internet users have bothered to connect to the world's first nationwide broad-band network. Singaporeans cite the high cost compared with normal modem dial-up, the fact that few applications require such advanced hardware and that they are not sufficiently enticed by those that do. Some even worry that connecting to the network will give the authorities even more access to their personal lives (McNulty: 12).

Conclusion

These cases illustrate the myriad of non-technological factors, including economics, culture, politics, and other specific national traits that must be considered in assessing the adoption rates of communications services and applications. The case of Singapore demonstrates the potential of government-driven initiatives to change an entire society's mode of operation. On the other hand, despite favorable economic and social considerations, Cable and Wireless HKT's inability to achieve its target goals for interactive multimedia service illustrates the importance of understanding end-users' "value system" as demonstrated by i-mode's success in Japan. Ultimately, widespread and rapid adoption of new communications technologies will depend upon the interaction between the "champion," social, and cultural factors, and finally, the end-user.

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[1] Singapore cable vision is owned by a powerful consortium comprising Singapore International Media (31 per cent), Singapore Technologies Pte Ltd (24 per cent), Singapore Press Holdings (SPH) (20 per cent), and the US-based Continental Cablevision Inc (25 per cent).

[2] Some observers however believe that government initiatives and grants for SMEs to go into e-business might be insifficient compared to the amount needed to set up a comprehensive site.

[3] Singapore's Ministry of Defence's IT arm, the Systems and Computer Organization, actually launched the world's first Internet-based government procurement system several years ago.

[4] For example, a study prepared by the Arthur D. Little consulting company estimated the benefits at $36 billion annually (Moore, 1995). These savings could be generated from: (i) *reduced costs for serving patients*, through savings in time and travel for doctors and patients, fewer unnecessary referrals, and the replacement of doctors with less medically trained personnel supported by Telemedicine (Moore, 1995); ii) *cost savings from the provision of better health care*, generating cost reductions from early diagnosis and treatment.

[5] Telemedicine also requires sophisticated hardware and high bandwidth as most Telemedicine applications need to be real-time, and "the more challenging and difficult the remote consultation and diagnosis, the higher bandwidth and processing power the clinical application will require" (Kim et. al., 1995). In sum, the technologies supporting Telemedicine are complex and, in a sense, disparate as they need to support videoconferencing, data transfer and database systems. In practice, these separate components must perform as an integrated unit to the user, hence accentuating the importance of user interfaces and information exchange standards.

[6] Under the Budget Reconciliation Act of 1997, Medicare will pay for teleconsultations involving a beneficiary residing in a county in a rural area designated as a "health professional shortage area." About 3.3 million Medicare beneficiaries live in the affected rural areas. Estimates from the Congressional Budget Office show that reimbursement will cost $200 million during the first five years, offset by savings of about $50 million.

[7] recommending possibly redundant or unnecessary procedures only to reduce the risk of malpractice suits

Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Innovative Public Policy: Calling for an Innovation Standard for Telecommunications Universal Service

Jay Edwin Gillette

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> It shall be the policy of the United States to encourage the provision of new technologies and services to the public.
>
> Sec. 7 (47 U.S.C. 157)
> [Communications Act of 1934, as amended] [1]

> Technology comes in successive waves. Those who have lost out on this wave can position for the next. Conversely, those who have made a killing on this cycle should not become complacent. The ability to profit under increasing returns is only as good as the ability to see what's coming in the next cycle and to position oneself for it-technologically, psychologically, and cooperatively.
>
> W. Brian Arthur [2]

1. Introduction and Summary: Realistic Universal Service through "Waves of Innovation"

One of the great regulatory dilemmas has been how to encourage telecommunications service providers to spread their best technologies and services across regions of their public markets toward a goal of "universal service" while not in practice making the minimum guideline become the maximum deployment.

This paper discusses a conceptual approach called "Waves of Innovation." The concept takes into account realistic deployment of new technology using a diffusion of innovation model. In real innovation, deployment comes in waves, and only gradually do individuals and communities move to new communication technology. That causes uneven development, and through increasing-returns economics, often results in "the rich getting richer, and the poor getting left behind."

The "Waves of Innovation" is a policy approach reflecting the spirit of Section 254 of the United States Telecommunications Act of 1996, which defines universal service as "an evolving level of telecommunications services."

2. Private and Public Policy that Rewards Leadership in Innovation

This policy breakthrough approach rewards vendors and communities for taking the lead in innovation, and especially through public and private partnerships.

The policy allows regulatory agencies to have a moving standard of innovation that constantly raises the bar for an entire region or state, so that the minimum guidelines or standards don't become the maximum deployment. It allows for partnerships and encourages the development of ongoing collaboration, especially between public entities. In the end, a "Waves of Innovation" approach can encourage and enable a to develop a culture of innovation.

3. Universal service: An Idea Whose Time Has Come, Gone, and Come Again

Universal service was designed in the 1930s to provide public policy that is succinctly stated: "The goal of universal service was to make basic telephone service available at an affordable price, anywhere in the nation." [3] By the 1980s, the goal was seen to have been accomplished, at least by the Bell System.[4]

Nevertheless, by the 1990s, after the breakup of the USA's Bell System in 1984, and with breakthrough technological and service advances, such as the personal computer and the Internet, pressure built to change the designation of universal service. Still, even in 1998 the FCC's definition of universal service still emphasized "basic services" (an approach from the early 1980s policy called "Computer Inquiry II"). [5] In practice this meant single-party telephone service; voice-grade access to the public telephone network; dial tone multifrequency or equivalent signaling; emergency services and operator access; access to directory services and long distance providers; and low-income subsidies. No "enhanced services" were included. [6]

As local regulators struggled to adapt the definitions to the needs of the time, specific regulations were enacted to try to keep up. The state of Kansas in the U.S.A. provided for reduced long distance rates to access Internet service providers in areas where local access was not available. The service had to support transmission speeds of 14.4 kilobits per second. This speed was seen as minimal, so the law required the speed to increase to 28.8 kilobits per second by 1999. Yet telecommunications companies were not certain they could guarantee such speeds, so they successfully lobbied for the law to change the rate to 19.2 kilobits per second in 1998.

These rates and these efforts point to the problem. Technologies change and advance, and capabilities change and advance. Once cast into law, these specific technologies and advances become the shape of the game: the lowest threshold guideline becomes the maximum provided the users or customers.

Yet the FCC did not specifically mandate the minimums described above. Let us review what the Federal Communication Commission characterizes as universal service:

> This rulemaking was initiated to define the services that will be supported by Federal universal service support mechanisms; define those support mechanisms; and otherwise recommend changes to FCC regulations to implement the universal service directives of the 1996 Act These directives are intended to promote the availability of quality services at just, reasonable, and affordable rates; increase access to advanced telecommunications services throughout the Nation; advance the availability of such services to all consumers, including those in low income, rural, insular, and high cost areas at rates that are reasonably comparable to those charged in urban areas. In addition, the 1996 Act states that: all providers of telecommunications services should contribute to Federal universal service in some equitable and nondiscriminatory manner; there should be specific, predictable, and sufficient Federal and State mechanisms to preserve and advance universal service; all schools, classrooms, health care providers, and libraries should, generally, have access to advanced telecommunications services; and finally, that the Federal-State Joint Board and the Commission should determine those other principles that, consistent with the 1996 Act, are necessary to protect the public interest. [7]

Section 254 of the Telecommunications Act of 1996 defines universal service as follows:

"IN GENERAL-Universal service is an evolving level of telecommunications services that the Commission shall establish periodically under this section, taking in to account advances in telecommunications and information technologies and services. . . . the definitions of the services that are supported . . . shall consider the extent to which such telecommunications services-

> "(A) are essential to education, public health, or public safety;
> "(B) have, through the operation of market choices by customers, been subscribed to by a substantial majority of residential customers;
> "(C) are being deployed in public telecommunications networks by telecommunications carriers; and
> "(D) are consistent with the public interest, convenience, and necessity." [8]

It is the challenge of regulators and community developers from local and national levels to find a way to enhance the spirit of this reasonable approach. Yet instead of defining universal service on a technological snapshot of time, we propose a different and more realistic approach: innovation as the standard for universal service.

4. Innovation theory: How to Understand and Foster Innovation

Technology and communications scholar H. Everett Rogers developed an important set of theories on the diffusion of innovations. In his seminal study on the topic [9], he analyzed adopters of innovations into five categories:

- Innovators (2.5% of adopters)
- Early Adopters (13.5% of adopters)
- Early Majority (34.0% of adopters)
- Late Majority (34.0% of adopters)
- Laggards (16.0% of adopters)

My understanding and experience is that these categories generally apply to organizations and communities as well. There are specific sets of values, characteristics, communication behaviors, and social relationships for the innovation adopters.

The issue for telecommunications public policy is to reward the communities and providers that move innovations forward in the region. The innovative communities need to be rewarded, and the following-on communities need to be encouraged. Convoys move at the speed of the slowest ship. That is designed to protect the slowest ship from attack. Yet public policy can not protect the slowest ship at the expense of the entire telecommunications convoy. That guarantees stagnation, and rewards laggards.

Instead, we need regulation that measures differences between the advanced communities and those most behind. Then we use the advanced community standard for a measure of where the next communities need to follow on. We reward the waves of innovation by assisting coalitions of communities and telecommunications providers in partnership, to bring the communities up to speed in new technologies and services.

5. Regulation and Policy that Rewards Leadership in Innovation

Regulation is often used to lock-in an obsolete technology and service strategic position by incumbent players and companies. See *Information Rules* by Shapiro and Varian, one of the most important books in the information economy [10]. How do we keep regulation from becoming a barrier against change?

New thinking is required. I recommend Tom Peters' breakthrough book *Thriving on Chaos: Handbook for a*

Management Revolution called for and reflected a major change in management thinking in the United States. The "Handbook for a Management Revolution" isn't obsolete even though it's now more than a decade old. Many regions are just now beginning the management revolution he foresaw at the time the book came out.

International institutions, political, economic and cultural, need the kind of revolution in thinking Dr. Peters calls for and outlines. Regulators worldwide can use this book to help them understand, participate in and forward the kind of changes required by the information economy. [11]

Here is the international perspective: you can't change social structures without changing thinking. This necessarily will lead to disruptions. You can't have progress without leaving something behind. The key is not to leave behind the people that new technologies and services are designed to serve.

In answer to the telecommunications "haves/have nots" question: people will wait their turn if they think their turn will come. The regulation issue is how to make sure their turn will come.

6. How we innovate in Telecommunications: A Model for the Movement and Use of Information

When we speak of innovation in this field, there is often confusion but what we mean. Telecommunications-the sharing of information at a distance, is really focused on the movement and use of information. For clarity, I have developed a four-layer model of the field of information networking, which I define as "the movement and use of information."

When we speak of the field, whether we call it "telecommunications" or "Information Technology (IT)," the components are included in the four layers of the "Information Networking Model" illustrated in Table 1, Information content, information form, information transmission or networking, and information technology.

Table 1
Information Networking Model: "The Movement and Use of Information"

Content: *what* is contained in the information and its interaction with the other dimensions; information management and public policy of information included
Form: the applications of information; *how* the information is used by the end-client and how the other dimensions affect information form.
Transmission/Networking: the methods used to move information from source to node to network. **"Networking"** proper.
Technology: the physical basis in equipment and programming that allow the movement and use of information.

Innovation can take place in any of these four areas, or in combination of them. Proposals for innovation should be taken to the regional regulatory body, comparing the position of the advanced community in innovation, and the position of the community and telecommunications provider coalition that wishes to advance. Their proposals should be considered in a competitive framework, and the coalition whose innovation moves the community and region forward the best should be rewarded with funding.

The source of the funding will vary according to national and regional policy. In the United States, the source would be federal and state Universal Services funding.

Information itself is the key, not information services in themselves. The standard should be, does the change proposed lead to "waves of innovation" in the region?

7. The Practice of Information Networking: How we "Do Information" in the Information Economy

"Knowledge is information on the move." [12] How we "do" information-our practice of information networking-is how we are able to know what we know. This movement and use of information is what telecommunications means. Information networking is what every vendor in the information economy is in business to do. Information networking is what every user is looking for. Users together make up organizations and communities from a telecommunications perspective.

With the goal of bringing clarity to the process, I've analyzed the practice of information networking into five main parts. (See Table 2: "The Practice of Information Networking.") The main categories are information *access, filtering, storage, retrieval, using.*

In general, we move and use information through these five steps, most often in this order. From one person getting a document off her desk, to a multinational corporation sending an email message, the process is similar. Even while you read these words, you are essentially going through these five steps, in the movement of the words from the page through your short-term memory to your long-term memory and back to your active awareness you use to understand the sentences.

To take in the entire analysis in one glance, I've given the information in familiar written form. The same information content is in Table 2. Here are the five main categories, followed by the second level of analysis of the main categories:

- **Access** (Input, Processing, Movement, Output)
- **Filtering** (Display, Selection, Classification, Prioritization)
- **Storage** (Organization, Placement, Securing, Indexing)
- **Retrieval** (Searching, Finding, Bringing Forth, Queuing)
- **Using** (Applying, Presenting, Distributing, Deploying)

Reading this list, from top to bottom and left to right, shows the overall movement and use of information. I have given a number of traditional computing and information management terms to my categories, to show how traditional approaches fit into this overall analysis. Most of what we call "information management" can be located in these categories, and that is a useful feature of the analysis.

Certain categories could go in more than one place, for example, "securing." This is a second-level category in information storage. We secure information after we have stored it through organization and placement. For example, in the physical world, in a workshop, you put your tools in a drawer of the toolbox, then lock the toolbox.

Yet security can also apply at the information access category. We might encrypt a message as we input it, for security. In my analysis, that could become a deeper category, say at the third level of analysis, of "input." And so on.

The purpose of this analysis of "the practice of information networking" is to help us understand where our own information practices fit in. The table gives an overall view for clarity, for a common language in discussing what we're actually doing as we move and use information, and as a guide to planning information networking initiatives.

Table 2

The Practice of Information Networking				
Main Category of Information Networking	**Second-Level Analysis of Information Networking Categories**			
Access	Input	Processing	Movement	Output
Filtering	Display	Selection	Classification	Prioritization
Storage	Organization	Placement	Securing	Indexing
Retrieval	Searching	Finding	Bringing Forth	Queuing
Using	Applying	Presenting	Distributing	Deploying

8. Conclusions: Apply Advanced Complexity Theory to Telecommunications "Waves of Innovation"

California economist Brian Arthur adapts the paradoxes of complexity theory in practical advice to technology leaders, beginning with a striking metaphor he calls "the Casino of Technology." (In order to emphasize several of his sentences, I carefully have separated his quotation with blank lines, but have not altered the punctuation or paragraph structure. Thus blank lines in the following quotes do not show paragraph breaks in the original text.)

Brian Arthur says:

> [T]he Casino of Technology requires several things: excellent technology, the ability to hit the market at the right time, deep pockets, strategic pricing, and a willingness to sacrifice current profits for future advantage.
>
> All this is not just a matter of resources but also of courage, resolution, will. And part of that resolution, that courage, is also the decisiveness to leave the market when increasing returns are

> moving against one.
> [. . .]
>
> Technology comes in successive waves. Those who have lost out on this wave can position for the next. Conversely, those who have made a killing on this cycle should not become complacent.
>
> The ability to profit under increasing returns is only as good as the ability to see what's coming in the next cycle and to position oneself for it-technologically, psychologically, and cooperatively.
>
> In high tech, it is as if we are moving slowly on a ship, with new technologies looming, taking shape, through a fog of unknowingness. Success goes to those who have the vision to foresee, to imagine, what shapes these next games will take. [13]

Professor Arthur, whom I believe will someday be recognized with a Nobel Economics Prize, helps us to conclude that communities that have been left behind by telecommunications advances need not despair. With a "waves of innovation" public policy to encourage the diffusion of innovation, the lagging communities may catch a new wave telecommunications technology. They may "leapfrog" from the laggard position to the innovator or early adopter category. Communities can ride waves of innovation to new definitions of telecommunications universal service.

Notes

[1] James Shaw (1998). *Telecommunications Deregulation*. Boston: Artech House, p. 349.

[2] W. Brian Arthur. (1996.) Increasing returns and the new world of business. *Harvard Business Review* (July-August 1996): 108.

[3] R. F. Rey, Ed. (1983). *Engineering and Operations in the Bell System*, 2nd Ed. Murray Hill, NJ: AT&T Bell Laboratories, p. 692, n.6.

[4] Ibid., p. 698.

[5] Ibid., p. 702.

[6] Lynne Holt. (1998). June 1, 1998 briefing memo to KUSF Working Committee, "Background Information/Policy Issues Re: Universal Service Fund," p. 6. Topeka: Kansas Legislative Research Department.

[7] http://www.fcc.gov/ccb/universal_service [online] 9/18/00.

[8] James Shaw (1998). *Telecommunications Deregulation*. Boston: Artech House, p. 221.

[9] Everett M. Rogers (1983, 1962). *Diffusion of Innovations*. New York: Free Press.

[10] Carl Shapiro and Hal R. Varian (1999.) *Information Rules: A Strategic Guide to the Network Economy*. Boston: Harvard Business School Press.

[11] I know, for example, of a military officer involved in the significant challenges of defense institutions today

who reads brief passages of the Peters handbook every morning to start his professional day.

[12] See Jay E. Gillette (2001.) "Information is Knowledge in Motion": A Practical Framework for Understanding Knowledge Management. In Richard Bellaver and John Lusa, eds. *Knowledge Management: The Practical Uses of Data Warehousing*. Boston and London: Artech House.

[13] W. Brian Arthur. (1996.) Increasing returns and the new world of business. *Harvard Business Review* (July-August 1996): 108.

Back to top of page **Back to the sessions page**

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Dr. Jay Gillette is Professor of Information and Communication Sciences at Ball State University's Center for Information and Communication Sciences in Muncie, Indiana.

Dr. Gillette teaches and conducts research in human communication; information networking design and development; telecommunications regulation, public policy and economics; leadership and management for the Information Renaissance; and information theory.

Previously, he was Professor and Associate Chair of the Department of Information Networking and Telecommunications at Fort Hays State University in Kansas. He helped set up the nation's first undergraduate degree in this new communication field, and also was a member of the industry team that helped develop Carnegie Mellon University's graduate degree in Information Networking.

Dr. Gillette served as a Senior Policy Fellow at the Docking Institute of Public Affairs in Kansas, and as a Senior Fellow of Information Technology and Telecommunications at the Center for the New West in Colorado, the policy research institute sponsored by U S WEST and other organizations.

He worked at Bellcore (Bell Communications Research) in New Jersey, now named Telcordia Technologies, as a Program Manager of the Information Networking Institute, as a Senior Technical Planner, and a Senior Project Manager in the company's Information Management Services division.

Earlier, Dr. Gillette was a professor of humanities and technical communication at the Colorado School of Mines. He also was an editor on the staff of the Mark Twain Papers at the Bancroft Library, University of California, Berkeley. He earned his Doctor of Philosophy and Master of Arts degrees in English at the University of California, Berkeley, and a Bachelor of Arts degree in Literature at the University of California, San Diego. In addition to his work in the information economy, Dr. Gillette has research interests in the impact of the industrial revolution in American culture, and in Mark Twain.

Back to proceeding page **Back to the sessions page**

Business & Applications

Monday, 15 January 2001
1100–1230

M.1.2 Application Service Providers

Location: South Pacific III / IV

Chair: ROBERT HARBISON, Principal / Analyst, Venture View Associates, *USA*

M.1.2.1 Call Center Based Mobile Commerce (ABSTRACT)

LUNG-SING LIANG, President and CHIH-CHENG CHIEN, Senior Project Manager, Telecommunication Laboratories, Chunghwa Telecommunication Corporation, *Taiwan*

M.1.2.2 Application Service Providing–A Chance for Carriers in Take-Off Countries? (ABSTRACT)

JOCHEN DINGER, Senior Consultant; MARC SCHNEIDER; NORMAN KOWALEWSKI; and STEFAN WILHELM, Detecon GmbH, *Germany*

M.1.2.3 The ABCs of being a CASP (ABSTRACT)

KEITH J. RHEA, CEO, IPX, *USA*

M.1.2.4 New Advances in Network Operations Support Systems (ABSTRACT)

PETER BARLETTO, Managing Director, Network Services & Operations, and MICHAEL G. KELLY, Director, Customer Care, TyCom, *USA*

Call Center Based Mobile Commerce

Lung-Sing Liang and **Chih-Cheng Chien**

Abstract

http://www.chttl.com.tw
http://www.cht.com.tw

1. Introduction

ChungHwa Telecommunication Corporation (CHT) operates both domestic and international telecom businesses. It also invests in related businesses, and other ventures as authorized by the Ministry of Transportation and Communications. Divided by regions and fields of business, there are six Business Groups as Northern Taiwan, Central Taiwan, Southern Taiwan, Long Distance and Mobile, International, and Data Communication. Northern Taiwan Group, Central Taiwan Group and Southern Taiwan Group serve local fixed telephone lines. Long Distance and Mobile Group processes inter-regional calls and mobile phones. International Group handles all international telephone traffic and calls. Data Communication Group manages all data communication needs and Internet services for Taiwan. Telecommunications Laboratories and Telecommunications Training Institute are the other two subordinates. The company also establishes District Operating Centers to serve customers.

Facing the challenge of competition in telecommunication market, CHT has been taking great value in maintaining good customer relationships and developing new client markets. For such purpose, it plans to develop integrated multi-function and multi-site call centers in different branches of Taiwan. The call center development of this company comprises six divisions, which are Telephone North-Branch (6 million customers), Telephone Central-Branch (3 million customers), Telephone South-Branch (3 million customers), Mobile Phone Branch (4.5 million customers), Data/ISP Business Branch (2 million customers) and International Telephone Branch. These divisions also maintain several remote sites to provide services. Telephone North-Branch call center exercises 100 seats in operation at this point and is expecting to expand into 500 seats in the future. Telephone Central-Branch and Telephone South-Branch plan to establish 400 seats for each branch. Inbound and web-dialing services are operated in Mobile Phone Branch and Data/ISP Business Branch, where else outbound and telemarketing services are still under construction in these two branches. Around 300 agents are serving in Mobile Phone Branch and 100 agents are employed in Data/ISP Business Branch. International Telephone Branch office is scheduled to build up their own call center to provide inbound and outbound services for the customer in the near future.

2. The Strategy for developing a Multi-site Call Center

CHT is originally transformed from its previously incarnation, the Deputy of Telecommunications, which is a government-owned organization that provides telecommunications services for the country. Therefore, most of the business rules are inherited from the old system and mechanism when the company is formed. What we have called it "a giant monster" under this circumstance is talking about the constraints and the barriers that CHT carries from its ancestor. The constraints and barriers, also known as a challenge that the company has met, are formed by plenty of variants such as long-term accumulative period of different organization processing rules due to different regions (Taipei, Taichung and Kaohsiung), different CHT branches (telephone, mobile, data/ISP and international telephone business groups), different people and administration styles. CHT is expected to become a privatized company after July 1, 2001. Before that, CHT has to follow the government procurement law since it is still a nation-owned corporation. The government procurement law proceeds with an open bid procurement procedure for the reason to avoid monopolization of big computer or software companies, and CHT ought to apply the rule strictly. This will lead to an ambiguous situation here when call center is built for different CHT branches and business groups. That is, since different procurement schedules and budgets are arranged for various CHT business groups, the open bid procurement procedure will result in purchasing different kinds of call center solutions, and maybe not the best one. The open bid procedure will also lead to a "priceless bid"; which vendor offers the lowest price, who will get the bid. This will also raise a major issue that it will be hard to solve system integration problem while building multi-site call center since CHT is a 50-years-old company with all kinds of heterogeneous legacy information systems.

To resolve the complicated situation caused by the historical background of a company like CHT, a progressive and flexible strategy in establishing multi-site call center is proposed. Since CHT is a telecommunications service provider that is already a major user of call center systems for its own support, service and marketing needs, it is recognizing the strategic importance of playing a major role in the call center services market. To follow the evolution trends as other mainstream telco companies in the world, CHT has the ambitions to exploit its market access and its expertise in delivering and supporting telco-based solutions to seek to dominate the call center services market. The strategy is to assemble a comprehensive portfolio of telco call center solutions, exploiting the customer premise equipment call center technology expertise that most vendors have - albeit in separate business groups. Technology partnerships with other call center suppliers will be considered, but only in the way that the product requirements that cannot be fitted into the business rules are customized. The barriers that CHT has faced to success are technical skills, multi-channels and systems integration. CHT will deliver its call center architecture on open systems, which has a wide range of benefits for the service providers - the benefits that reduce lifecycle costs and allow inter-working between service platforms.

Figure 2.1 shows the replaceable 3-tier architecture that is proposed as a development strategy plan to accomplish multi-site call center of CHT. The first layer of the architecture is Customer Application Service System (CAS). It is a customer relationship management system that helps agent in the call center to take complaints or service orders from customers as well as provides telco services to the customer. CAS generates trouble tickets when complaint or service cases are unable to be solved by the first-line agent. The second layer is the CTI Integrated Platform that integrates essential call center equipments to maintain customer information and call data. The third layer, Legacy MD System (LIS), is a middle-ware interface to connect various legacy information systems of CHT. Under this architecture, agent is able to provide more efficient and effective information to the customer through the capability of accessing or linking to the back-office supporting systems. Complaint or service tickets will also be taken care of by the back office systems.

CAS is a proprietary client application system that has been pretty much customized into telco service business flow. In the first development phase of the strategy plan, CAS is installed for identical business group in CHT. CTI Integrated Platform at this stage is provided by vendors, which will probably be more than one integrated solutions for different business groups due to the open bid procurement procedure. Only one LIS is installed in CHT to support all the CAS needs. The whole idea is that, each layer of the architecture is packaged into component, hence everything can be substituted by other components to expend the flexibility of the solution. The second development phase will move towards the deployment of multi-site call center solution. CAS of each call center site is linked by the CHTNet (IntraNet of CHT), so that the ticket and customer information can be flowed between multi-sites. Further on, move to the third development phase, will get each CTI Integrated Platform through to transfer calls (voice) or making conference calls between sites. The requirement of the distributed call center deployment is owing to call center sites are distributed into separated business groups or branches. There will be needs to transfer calls when one site becomes saturated, or in the situation that the agents in each location has less qualified skills.

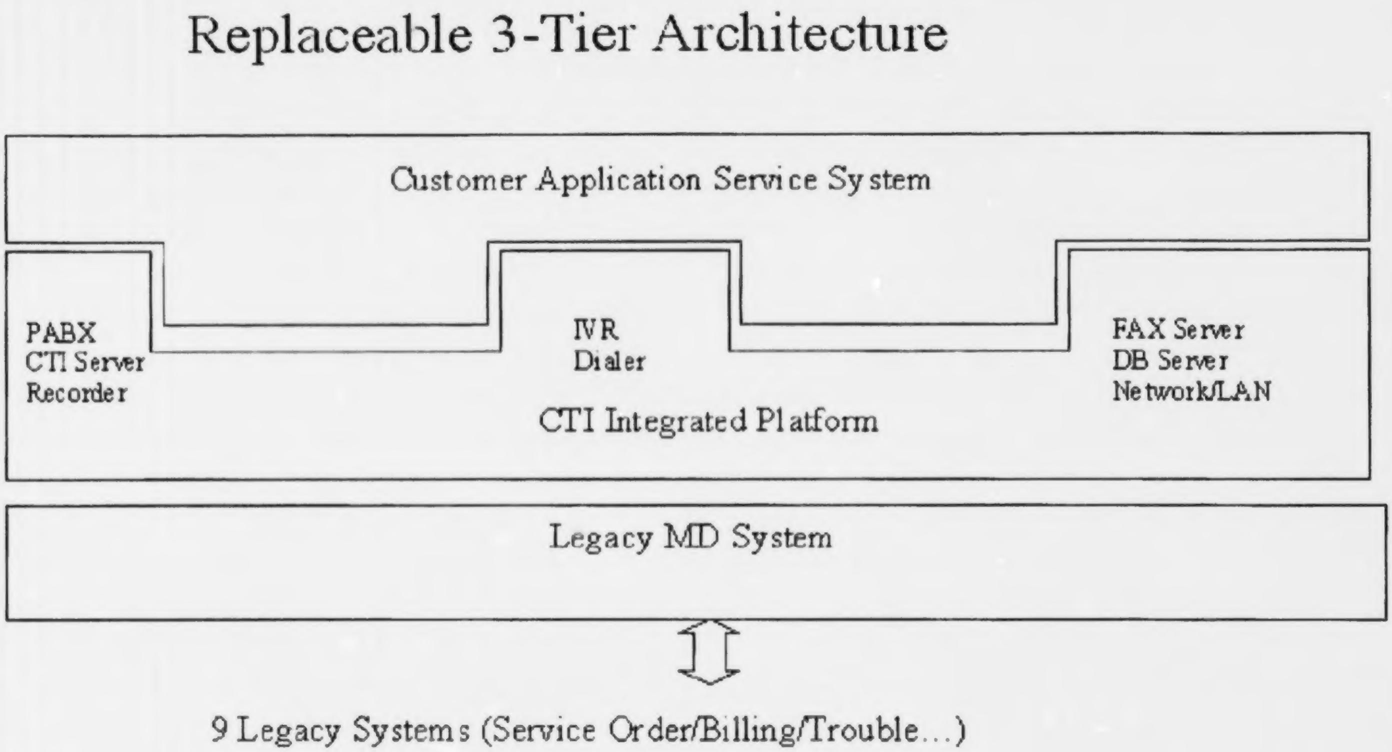
Replaceable 3-Tier Architecture
Customer Application Service System
PABX
CTI Server
Recorder
IVR
Dialer
FAX Server
DB Server
Network/LAN
CTI Integrated Platform
Legacy MD System
9 Legacy Systems (Service Order/Billing/Trouble…)

Figure 2.1 Our Strategy (Phase 1)

3. System Architecture of Call Center of CHT

Figure 3.1 describes the basic architecture of CHT's call center site. From the vertical cutting point of view, CHT's customer can reach the call center through various channels including Conventional Telephone, Fax, E-mail, Internet (chatting or data collaboration), Internet Phone (VoIP) or Wireless AP Protocol. CTI Platforms operate front-end office equipments from IVR, PABX, CTI/FAX/E-mail server, Dialer to Web server to provide an interaction channel integration facilities of the call center. Calls or contacts made by various means are distributed to the appropriate sites, groups and agents, and CAS stands by at the client's desk to help services. Any services that need to be supported by the legacy information systems of CHT (i.e. Service Order System, Billing System, etc), customer information can be always accessed by LIS to provide real-time services.

From the business grouping point of view, here is how a customer's call is distributed (Figure 3.2) under this architecture. The customer simply dials call center representative service number "123". IVR will ask the customer to select business category before it starts to provide services, and if the customer needs to talk to an agent, the system is then able to route the call to the appropriate business call center site (i.e. Telephone business, Mobile-phone business or DATA/ISP business). Even if a call has been routed to a telephone business call center agent, he/she is able to transfer the call to remote agents through the CHTNet in case the customer needs service besides telephone business.

From the functional point of view, the architecture collaborates from three aspects - Function side, Platform side and System side. The Function side includes Voice Handling, Call Handling and Business Handling functions where Voice Handling handles IVR, FAX Voice Mail Recording & Monitoring systems; Call Handling manages call flow controls, intelligence call distribution, agent software phone and outbound dialing; Business Handling handles business domain services such as ticket ordering, ticket processing, ticket analysis, telemarketing, legacy integration, unified messaging and system managements. The Platform side will provide PABX (with or without CTI), unPABX (industry standard or non-industry standard), CTI, Web-based (E-chatting and co-browsing) and IP-based (call back request, IP telephone gateway and IP-centric) solutions to achieve multi-channel interactions with the customers. Lastly, the System side integrates Customer Service Systems from help desk system, CRM software to specific system, CTI Service Systems, Data Warehousing and Legacy Integrated Systems as well as Performance Analysis Systems that include real-time/historical reporting and analyzing system, work force management and scheduling system.

4. Internet-based Electronic Commerce

CHT offers, since early 1997, first generation web-counter services which allow CHT's customers to do businesses via Internet. In lieu of an automatic dispatching system, that web-counter passes on every business order to more than 200 operational units by fax or E-mail. Hence, more manpower is needed, efficiency is poor, and the customers can't be kept informed on the status of their orders on the web. Starting early this year, CHT is pushing ahead with the planning and installation of second-generation web-counter services. Combined with e-commerce and customer relationship management (CRM), this 2nd generation system will offer entirely new web e-counter services. Mobile phone web-counter was put on-line Oct. 31st and performs well. Other services are scheduled to get on line by the end of the year.

This system retrieves and checks customers' data automatically from, as well as dispatches business order, DIYed by on-line customers, for processing to CHT's legacy systems via LIS. It shares hardware equipment and operation procedures and operates closely with Call Center. Legacy off-line orders will be handled along with Call Center's off-line ordering tickets, just as if they were placed through service hot lines. Customers are also able to call up Call Center using web hot line through Internet Telephony Gateway (ITG) to talk to a customer service agent for further services. After authenticated by Certification Authority (CA), customers could settle a bill on line through Payment Gateway (PMG). Shown in Fig. 4-1 is the block diagram of this system.

Among major functions of this system are promotion campaign, bulletin board, service list, service center list, Q&A, ordering, data change, special functions, suspension, bill request, call records, trouble shooting, status inquiry, financial statement etc. On top of that, customers got a web hot line to get vocal connection with Call Center and are able to make comment on the web.

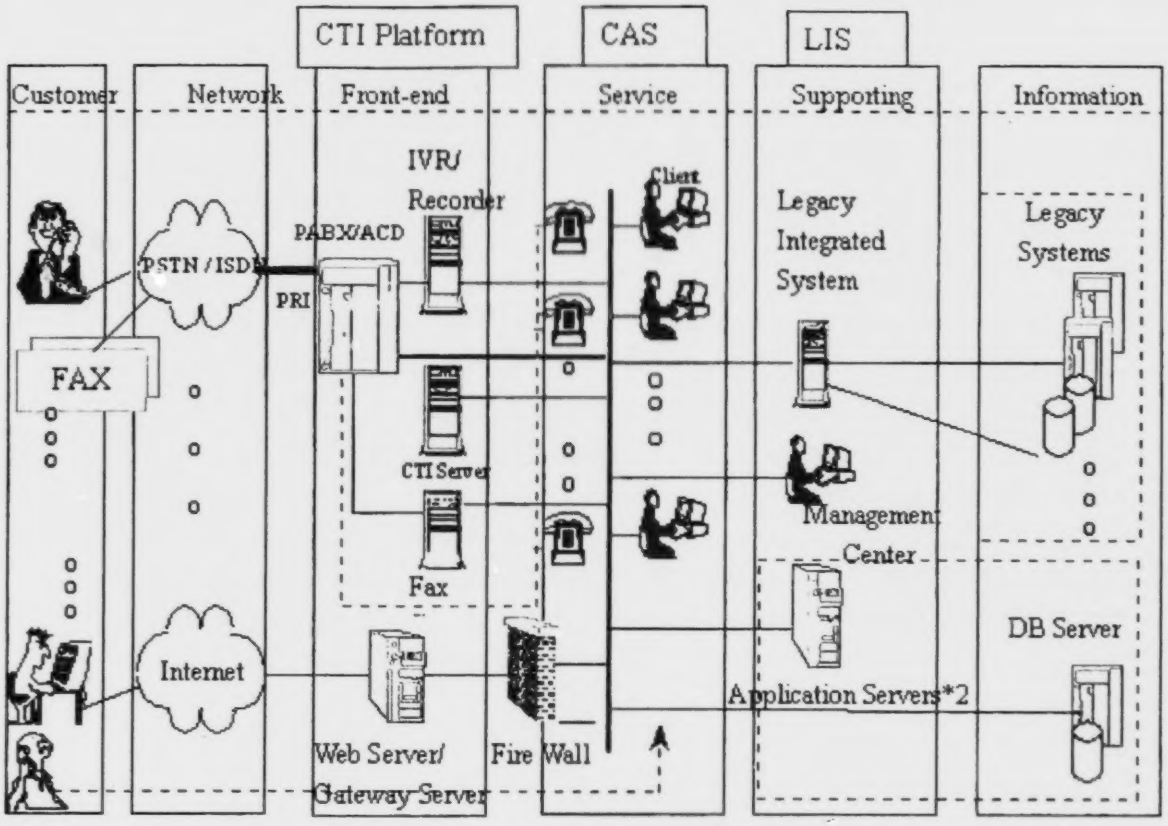
CTI Platform
CAS
LIS
Customer
Network
Front-end
Service
Supporting
Information
PSTN / ISDN
PABX/ACD
PRI
IVR/ Recorder
Client
Legacy Integrated System
Legacy Systems
FAX
CTI Server
Fax
Management Center
DB Server
Internet
Web Server/ Gateway Server
Fire Wall
Application Servers*2

Figure 3.1 Basic Architecture of CHT Call Center - System Information

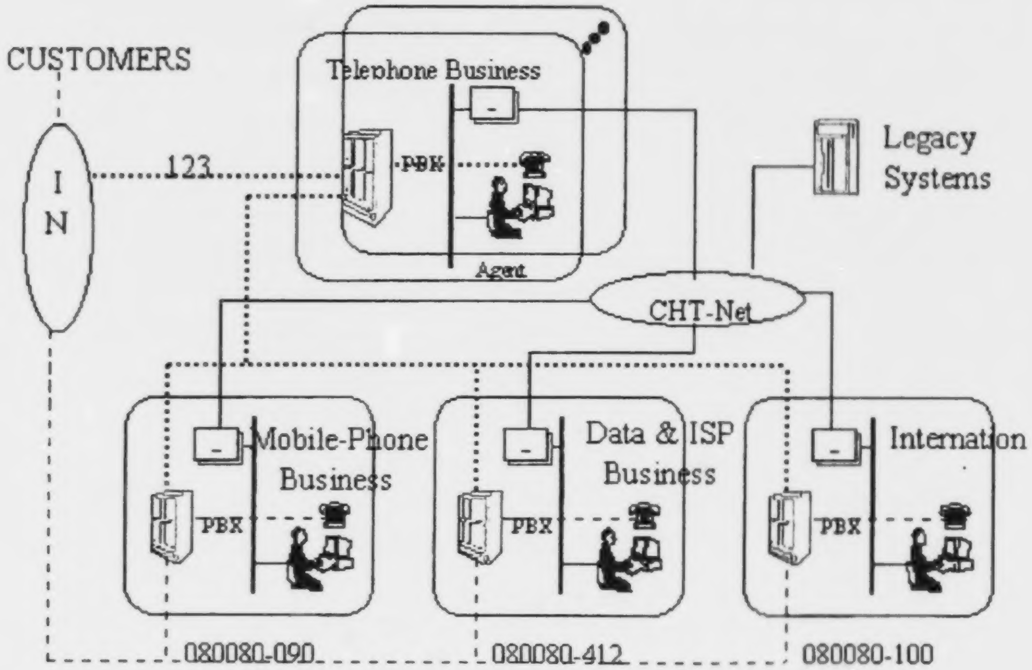
CUSTOMERS
I N
123
Telephone Business
PBX
Agent
Legacy Systems
CHT-Net
Mobile-Phone Business
Data & ISP Business
International
PBX
PBX
PBX
080080-090
080080-412
080080-100

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Figure 3.2 Basic Architecture of CHT Call Center - Business Group Distribution

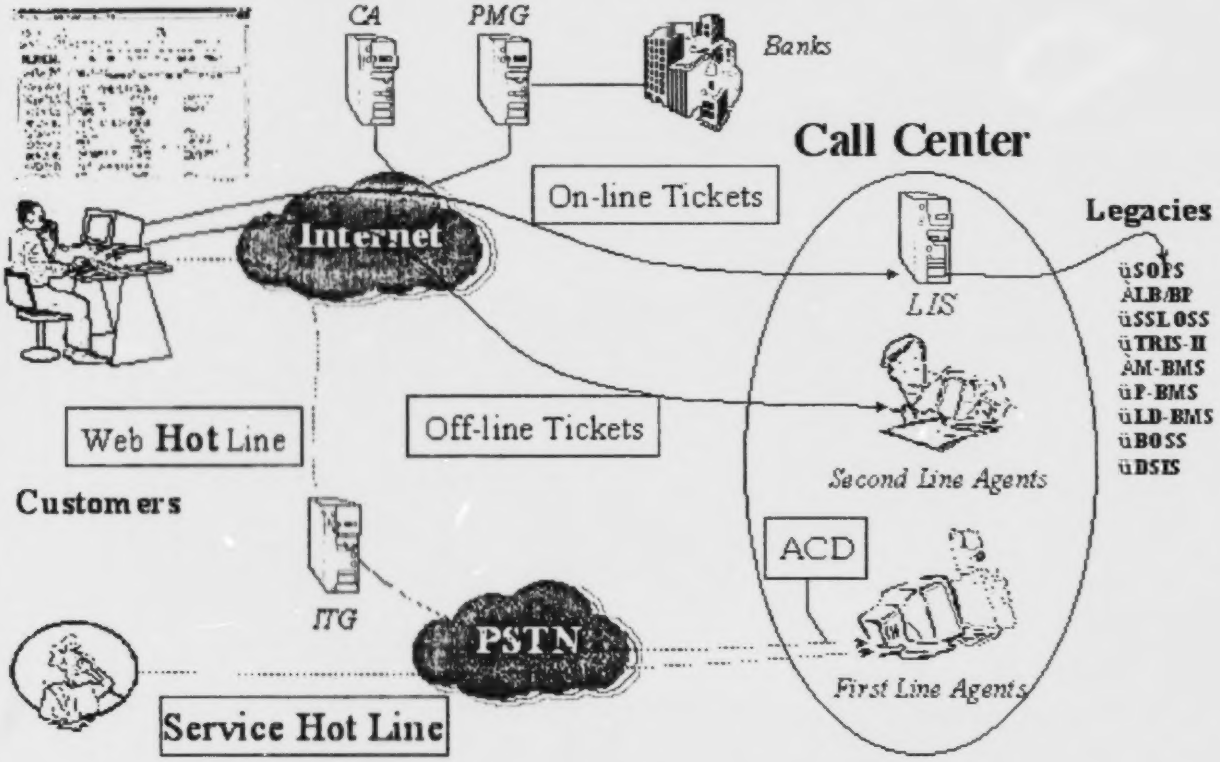
CA
PMG
Banks
Call Center
On-line Tickets
Internet
Legacies
LIS
üSOPS
ÀLB/BP
üSSLOSS
üTRIS-II
ÀM-BMS
üP-BMS
üLD-BMS
üBOSS
üDSIS
Web Hot Line
Off-line Tickets
Second Line Agents
Customers
ACD
ITG
PSTN
First Line Agents
Service Hot Line

Fig. 4-1 Block Diagram of Second Generation Web-Counter Service System

Following are some descriptions of Chat's on line mobile phone ordering procedures. A list of available phone number and a lease contract will be displayed after customers select the ordering service. Customer is required to fill in some personal information, services required, method of payment (billing, financial card, and credit card), and method of delivery (registered mail, special delivery). The orders will be accepted after a preliminary check on the information supplied is made on line by Chat's legacy systems and the bankers named by the customer. The order will be double checked by Chat's second line Call Center agent and then passed on to Chat's billing system and relevant business unit for card issuing and delivery office assigning. Delivery offices would download a delivery list from the web daily and make the delivery. Customer could open the card on the web or calling the service hot line, after receiving the SIM card. Otherwise, the card will be open automatically a week later.

Features of this system are as follows:

- All services are offered: fix line subscription, mobile phone, IN, digital line, international call, etc.
- Information about a lot of activities available: discount activities, bulletin board, services offered, service center, Q&A.
- Services: ordering, change request, special functions, suspension, bill request, calling record, trouble shooting, status inquiry, financial statement, opinion input.
- Electronic services: e-billing, e-receipt, web-payment
- Bulk processing: a bulk of billing addresses can be changed at one stroke.
- Automatic operation: accessing legacy systems via LIS, web processing via intranet; achieving total

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automation.
- Close cooperation between web-counter and Call Center: sharing equipment, functions, data, action to save cost and provide integrated services.
- Customers can be kept informed via web: status on orders filled both on web and with Call Center is available on web.
- Integrated business operation: information flow, money flow, material flow are integrated for access from.
- Security for business transaction: authentication procedure provides security for business transaction.

The second-generation web counter service system will expand and increase either in terms of the number of services offered or the function performed. Communized and personalized services are possible with the help of membership and customer data bases, hence the VIP treatment for web users.

5. Mobile Commerce through Call Center

Beside the after sales services and e-commerce offered via Call Center and web counter, CHT is also planning and implementing Mobile Commerce services. Scores of these services available, implemented by ourselves and supplied by our business partners, can be divided into Q&A, household information, and on-line shopping three categories. Some of the services can be accessed with WAP phone or others. The rest are only accessible via WAP phone, due to special operation features needed.

The categories of the Mobile Commerce System:

- Q&A: WAP handset owners would get to see many CHT's business offers and discount advertisement on their set. The owners could inquire the details of their bills, including account balance and payment records, when they have any questions. They could also get a detailed explanation about any functions they try to find out. For instance, the utilization of voice mail, or sending short messages.
- Household Information: Internet has become involved with people's daily life in so many ways, including searching all kinds of Household Information. So is WAP. Users could easily access information on news, weather, tourism, traffic situation, medicine, entertainment, finance, etc. with a few light touch of their finger.
- On-line Shopping: On-line Shopping offers procedures for making business transaction via the web. Q&A and Household Information are offered free of charge, while on-line shopping are paid services. Following commodities are offered now:

    - logo and music ring tone download: With the cooperation of WAP venders, WAP users have a big selection of logos and ring tones to download; with just a simple procedure the logo and ring tone of the handset can be replaced. This is especially catered to e-generation boys and girls.
    - mobile bank: With the cooperation of several banks, CHT's customers are able to, on their WAP handset, check out their bank account balance, transaction records, interest rate, currency exchange rate and information on financial funds, or make fund transfer, report lost on financial card, change password, making it a lot easier to do their financial management.
    - mobile stock dealer: In connection with several security firms, CHT's customers are able to check out stock prices, personal stock account statement, or make deals. Customers could make investment and do financial transactions while on the move.
    - mobile ordering: In connection with several firms, CHT's customers are able to download onto their handset catalogs on a range of products and merchandises, including computer software/hardware, household electrical appliance, household articles, sport goods, and audio and video equipment and make purchase on line.
    - mobile tourism: In cooperation with several travelers' agencies, CHT's customers are able to check over travel packages and sign up on line.

E-commerce has made huge impact on our life-style and our industries. Mobile Commerce services could go even further. What CHT is offering is only a start. It is expected to have more services, richer content and easier operation in the future. With the advent of GPRS and third generation mobile communication services, important breakthroughs in wireless bandwidth and form of display, mobile commerce will have a very colorful and bright future.

6. Summary

By introducing a live support option into an e-commerce strategy, the Mobile-Commerce Call Center will improve the effectiveness of the online and multi-channel process. This will be done by increasing the number of people willing to use mobile phone as a commercial channel and simultaneously decreasing the number of aborted (or failed) WAP transactions.

Online commerce is still relatively new; many people have said that they would be more inclined to use mobile-commerce if there was some kind of familiar, human element involved. By simply including a 'call agent' button on CHT's mobile phone screen as well as the interface, customers that have previously felt uncomfortable buying online will consider mobile-commerce as a viable means of doing business. Adding the human touch to CHT's WAP services is an easy way of widening CHT's customers base and maximizing our online profit potential.

No web- or mobile-commerce strategy can rival a live agent for cross selling or dealing with spurious requests. The most effective e-commerce strategies will therefore involve a web- or mobile-commerce call center agent. A further benefit of e-commerce call center agents is that they can get live interaction with customers on the web or mobile phone presale and can guarantee that transactions are completed successfully after customers have committed to the sale. A significant proportion of online shopping carts are abandoned before the 'submit order' button is pressed. Of the small number of orders that are submitted, significant proportions are incorrectly completed. At worst, these orders will be unrecoverable; at best, customers will need further contact before their order can be processed - increasing the cost of the transaction. Therefore, by combining the verbal and visual assistance from the agent with simple, human touch of man-machine interface, CHT's multi-channel call center should be able to take communicating with the customer to new heights of effectiveness.

To maximize CHT's market profit, a strong and manifold call center infrastructure should be established in order to provide various services not only telco-related, but also in fields of banking, stock market as well as other customer service domains. We will move on from what we have built presently, to a future of a value-added call center by combining and providing B2B, B2C and mobile-commerce, presale, after service, call center system integration solutions, CRM solutions, network-based call center solution to become an application service provider, and further more, to outsource CHT's call center to middle and small business in the market.

As we gradually build up the total solutions of CHT's call center by either integrating tools from the vendor or self-development, we are marching CHT's call center from cost center to profit center. Call centers are where businesses talk to the customers, discovering customer's requirements, persuading them to perform business transactions and satisfying their requirements; call centers are also having an important advantage over integrating self-service media to customers - they allow businesses to be proactive in ways that would often be rejected or ignored when self-service media are used. These are the two main reasons why CHT's call centers will remain the strategic customer relationships. We realize that CHT's call centers generate even larger amounts of revenue (whether directly through sales or indirectly through service) by taking the following strategy into account:

- the different contact media
- the value of the different customer group, including high-value or low-value customers
- the value of the different transactions

- our customers' reasonable expectations of service, providing different service level for different value of customers

In the expectation of the above strategy, maximizing the effectiveness, efficiency and profit of the call center is, therefore, a high priority, and this is the factor that makes the call center market extremely attractive to us.

Back to top of page **Back to the sessions page**

Lung-Sing Liang

Dr. Lung-Sing Liang, President of Chunghwa Telecom Labs (CHT-TL), received his B.S. degree in Communication Engineering and M.S. degree in Electronics Engineering from the National Chiao-Tung University in 1975 and 1978 respectively. He got his Ph.D. degree in Electrical Engineering in 1990 from National Taiwan University. Dr. Liang started working in 1979 at the Telecommunication Laboratories, Ministry of Transportation and Communications, serving different positions such as assistant researcher, associate researcher, researcher, and managing director, etc. In 1998, Telecommunication Laboratories was corporatized and renamed as Chunghwa Telecommunication Laboratories. Due to his outstanding achievements, Dr. Liang was promoted as the Vice President of CHT-TL in 1996, mainly responsible for the research of telecommunication technology, and was promoted as the President of CHT-TL in October 2000. Dr. Liang is also in the interim the managing director of Wireless Communication Technology Laboratory of CHT-TL, leading the mobile commerce and wireless communications planning & OSS development based upon GSM, cdma1x and 3G systems.

Dr. Liang's wide research interest covers the technologies of Broadband ATM switch, access protocols for VSAT system, Operation Support Systems, Call Center/Customer Care, Billing System, NGI protocols, QoS, and Ipv6. Dr. Liang received both "The Outstanding Young Engineers Award" and "Outstanding Ten Engineers Award" from Chinese Engineering Association in 1990 and 1996 respectively. Several of Dr. Liang's technical papers were published on international journals and released at international conferences. To confirm his great contribution to the telecommunication technology research, the Executive Yuan even presented him an "Outstanding Research Paper Award" in 1997.

Dr. Liang has had many years' experience of teaching in the universities: the adjunct associate professor of National Central University and Chung Yuan Christian University. During the Y2K crisis period, Dr. Liang was assigned to be CHT-TL's project manager of Y2K Project, responsible for offering technical support to Chunghwa Telecom Business Units. Dr. Liang is also quite active in participating global telecom activities: being the secretary of Pacific Rim Frame Relay, ATM, SMDS Interest Group (PRFASIG), and now the chairperson of ATM SG in AOW since 1996.

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PROFESSIONAL INTERESTS

1. X.25 Packet Switch, X.25 PAD, Statistical Multiplexer

2. Access Protocol for VSAT system, FIBER to the home
3. ATM Switch and Broadband Services
4. Switching Operating Support System

EDUCATION

1. B.S. degree in Communication Engineering of National Chiao-Tung University, R.O.C., 1975
2. M.S. degree in Electronics Engineering of National Chiao-Tung University, R.O.C., 1979
3. Ph.D. Candidate of Illinois Institute of Technology, Chicago, Illinois, USA, 1984
4. Ph.D. degree in Electronics Engineering of National Taiwan University, R.O.C., 1990

CURRENT

Vice president of Telecommunications Laboratories (TL), CHT Co., Ltd., Taiwan

Secretary of Pacific Rim Frame Relay, ATM, SMDS Interest Group (PRFASIG)

Chairman of ATM SG, AOW

EXPERIENCE

1. Assistant Researcher, Computer Research Laboratory, 1979~1982, TL, Taiwan.
2. Associate Researcher, Computer Research Laboratory, 1982~1986, TL, Taiwan.
3. Researcher of Network Planning Laboratory, 1987~1991, TL, Taiwan.
4. Director of Switching Technology Laboratory and project manager of Broadband Switching & Services Technology, 1991-1996, TL, Taiwan.

HONORS

- Outstanding Ten Young Engineers of 1990, Chinese Institute of Engineers.
- Outstanding Ten Engineers of 1996, Chinese Institute of Engineers.
- Outstanding Research Award of 1996, Executive Yuan, Taiwan, ROC.

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1. "The Channel Error Effect on Contention -based Multibit Reservation TDMA protocol", IEEE VTC' 90

2. “Response Time Calculation for VSAT Networks”, IEEE MILCOM‘ 90

3. “The Effect of Channel Errors on the performance of a contention-based TDMA protocol”, International Journal of Satellite Communications

4. “The Development of Switched-Star Integrated Video/Audio/Data Broadband Fiber Subscriber Network”, IEEE SICON‘ 91

5. “Performance Evaluation of the Parallel-Buffered Banyan Switch in TL of Taiwan”, ITS‘ 92

6. “Performance Analysis of two Echo Control Designs in ATM Networks”, IWACA‘ 92

7. “SMDS R&D Efforts in TL”, First PRSIG SMDS Workshop

8. “A Wuick Admission Control Strategy Based on Simulation and Regression Approach”, IEICE, TRANS. Communication, Japan

9. “A Field Trial for laboratory Experimental Broadband Switching System”, New Orleans Supercomm/ICC‘ 94

10. “Design, Implement and Performance Measurement of Multipoint Video-conference Bridge (MPVCB) over ATM”, New Orleans Supercomm/ICC‘ 94

11. “Hardware Reliability and Availability Predication of a Broadband Switching System”, 1st IEEE International Workshop on Broadband Switching System, Poznan, Poland

12. “Performance Evaluation of a connectionless Data Server In B-ISDN Based on Simulation Experiments” Workshop on New Directions in Simulation for Manufacturing and Communications, Japan.

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2. L.S. Liang & J.F. Chang, “The Effect of Channel Errors on the Performance of a contention-based TDMA Protocol”, International Journal on Satellite Communications, VOL.9, p.23-p.35.

3. L.S. Liang & J.F. Chang, “The Effect of Channel Errors on the Performance of a Hybrid Contention-based TDMA Protocol”, IEEE Tr. on Aerospace and Electronic Systems.

4. L.S. Liang, “Time Server in Advance Automation Local Area Network”, Computer Standards & Interfaces 8, Elsevier Science Publishers B.V. (North-Holland) PP.223-227, 1989.

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6. Time Server in Advance Automation Local Area Network, Computer Standards & Interfaces, Vol.8, p.223-p.227, 1988.

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8. Performance Analysis of two Echo Control Designs in ATM Networks, IEEE/ACM Transactions on Networking, VOL.2, No.1, February 1994.

Back to proceeding page **Back to the sessions page**

Application Service Providing - A Chance For Carriers In Take-Off Countries?

Jochen Dinger

Abstract

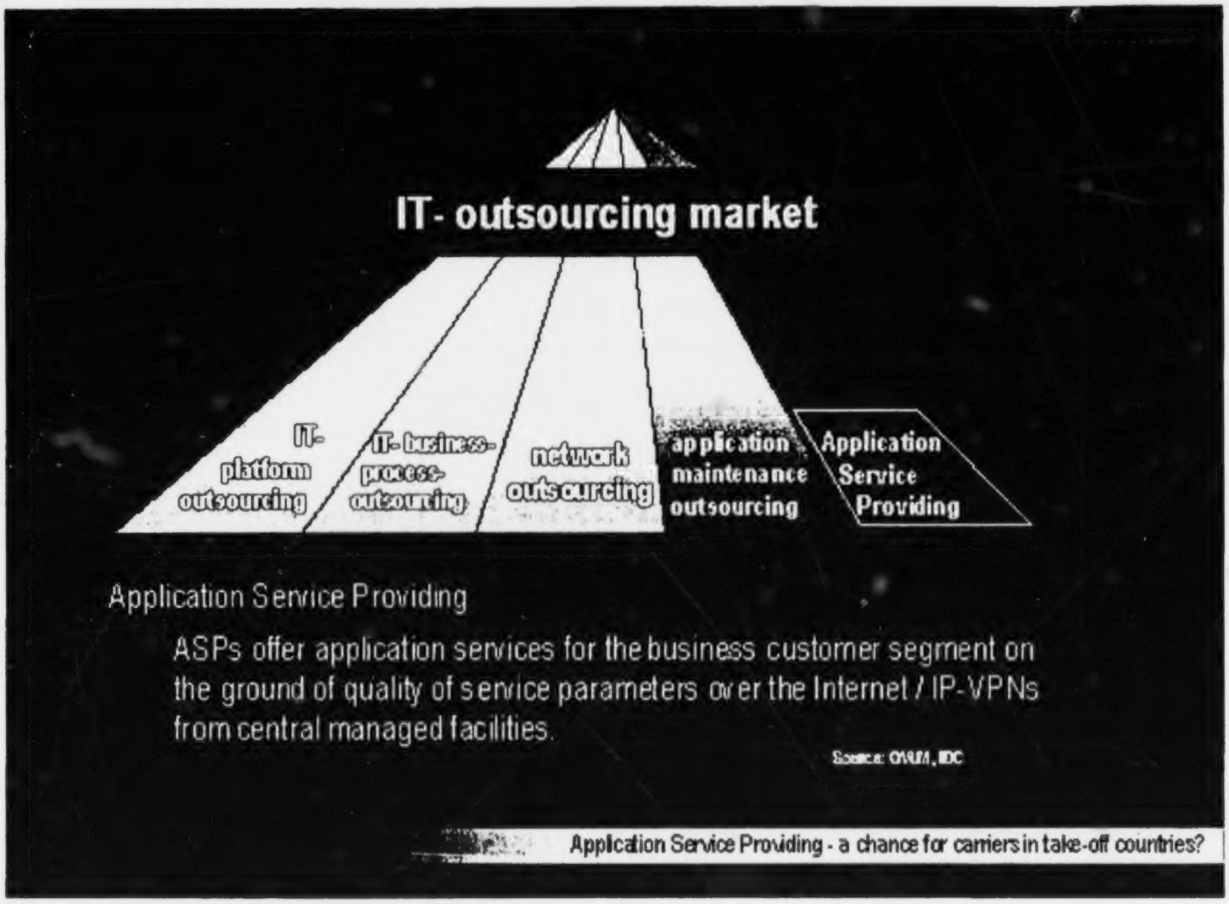
http://www.detecon.com/

1. Application Service Providing

Before evaluating the size of the ASP Market, the players and the required skills it is necessary to define the market we are discussing.

The Application Service Provider market is part of the IT- outsourcing market [1] which includes:

- **IT- platform-outsourcing**
  (offering data center services, incl. hardware management and support services),
- **IT- business-process-outsourcing**
  (i.e. billing and accounting),
- **network-outsourcing**
  (i.e. outsourcing of the administration and operation of WANs and LANs)
- **and application-maintenance-outsourcing**
  (this is the traditional way of software outsourcing, i.e. managing the applications at the customer´s place).


IT- outsourcing market
IT-platform outsourcing
IT-business-process-outsourcing
network outsourcing
application maintenance outsourcing
Application Service Providing

Application Service Providing

ASPs offer application services for the business customer segment on the ground of quality of service parameters over the Internet / IP-VPNs from central managed facilities.

Source: OVUM, IDC

Application Service Providing - a chance for carriers in take-off countries?

ASPs offer application services for the business customer segment on the ground of contractual quality of service parameters over the Internet / IP-VPNs [2] from central managed facilities.

Network outsourcing where companies hand over the management of their networks or their business processes like billing to other companies have been around for years. Application Service Providing is a new market and is still relatively small compared to other outsourcing markets, but with a huge market potential. Some say it is even bigger than all other IT-outsourcing markets combined.

The main reason behind the emergence of the ASP market in the past 2 years is the development of the internet and the cheap high volume access which evolved with it. Software vendors like SAP or PeopleSoft have seen the market opportunity to sell their products not only to corporations, but increasingly to small and medium size companies. These companies are usually not prepared to pay millions for the implementation of tailored software, but are well prepared to pay a couple of hundred or thousand dollars monthly for the use of standard packages.

The ASP model is however, not just a new sales channel for software products where a third-party supplier offers applications on his server resources to his end-customers over the Internet or IP / VPNs on the basis of a monthly usage fee.

An ASP may also aggregate different software solutions to form a special package of applications which meets the customers´ needs or offer additional services like security, monitoring or a 24/7 help desk.

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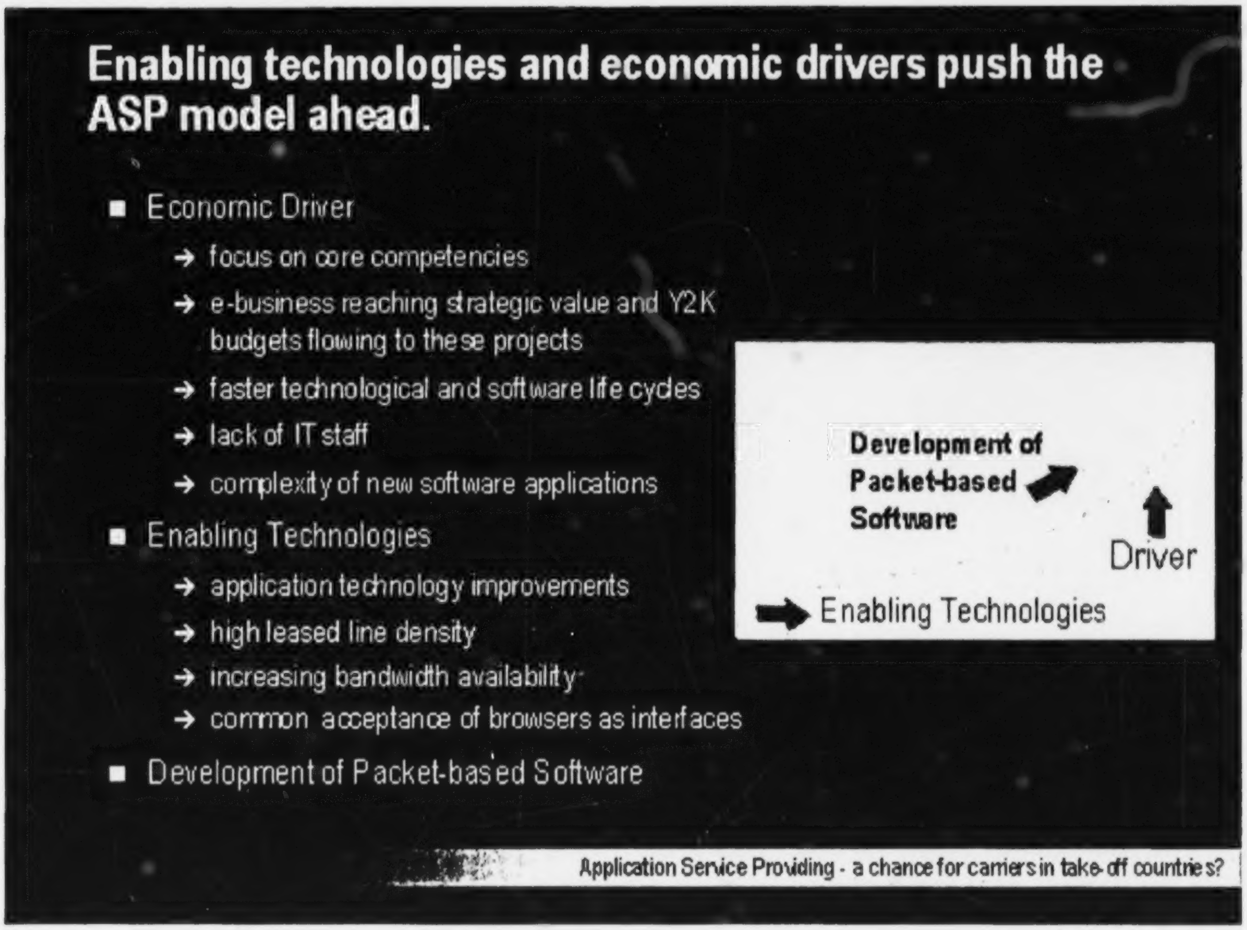
The range of the software offered goes from simple e-mail applications to complex enterprise applications such as e-Procurement or Customer Relationship Management (CRM) software.

There are several factors which make ASP interesting for companies, like having access to new applications and sales devices, reducing the time-to-market and the predictability of costs as well as cost advantages through economies of scale. In addition ASP allows scalability with business growth, access to IT expertise, professional security and supporting focus on core competencies through effective allocation of scarce resources.



Enabling technologies and economic drivers push the ASP model ahead.

- Economic Driver
    - → focus on core competencies
    - → e-business reaching strategic value and Y2K budgets flowing to these projects
    - → faster technological and software life cycles
    - → lack of IT staff
    - → complexity of new software applications
- Enabling Technologies
    - → application technology improvements
    - → high leased line density
    - → increasing bandwidth availability
    - → common acceptance of browsers as interfaces
- Development of Packet-based Software

Development of Packet-based Software

Driver

Enabling Technologies

Application Service Providing - a chance for carriers in take-off countries?

These factors and a huge addressable market (which cover large corporates to small and medium-sized enterprises, as well as dot.coms/start-ups) are the reasons behind the huge growth rates of the ASP market.

2. ASP - an opportunity for the Asia-Pacific region

Market Forecast

The forecast for the world-wide ASP market projects revenues will climb from $3.1 billion in 2000 to $99.64 billion in 2005 [3] (CAGR 203%). Revenues in the Asia-Pacific region will climb from $223 million to $9.1 billion during the same period.

Express growth is expected over the short- to medium-term and eventually will begin levelling out as markets like in

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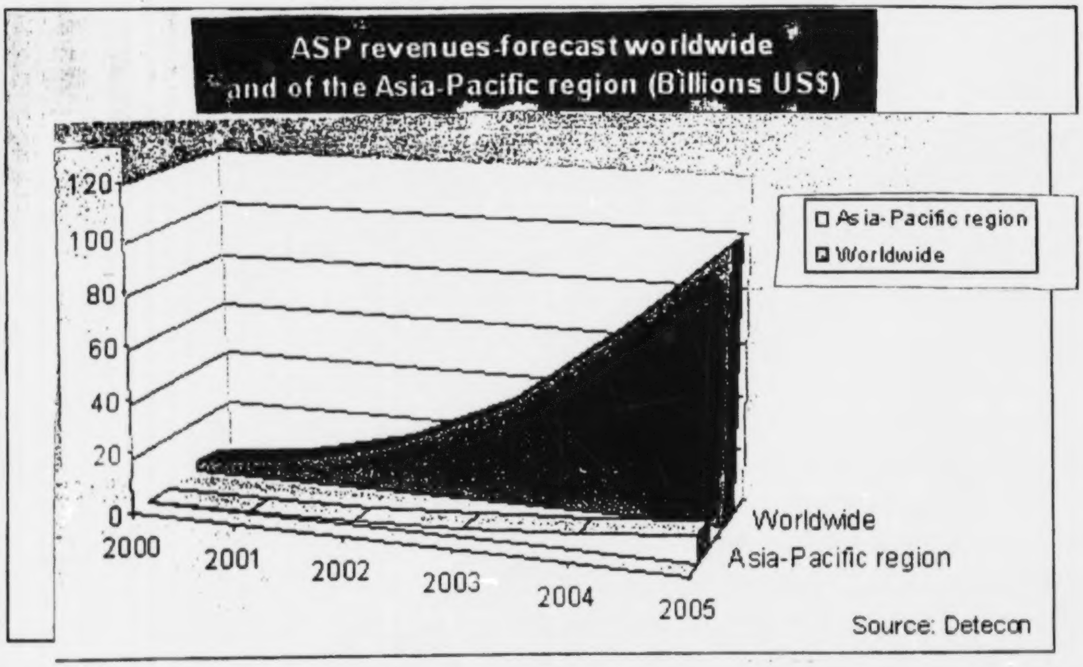
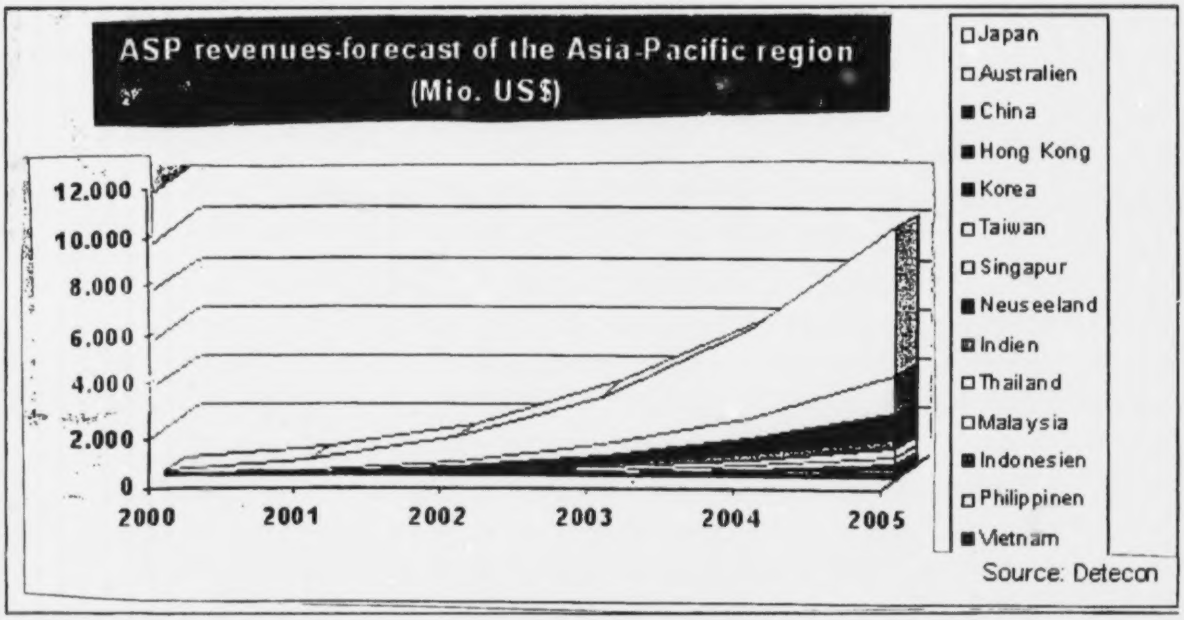
the US mature.



Source: Detecon

The Asia-pacific region growth is expected to mushroom as bandwidth availability increases and costs especially for cross border bandwidth start to come down. The major markets in the Asia-Pacific region are Japan, Australia, China and Hong Kong. Japan has a market share of 59% of the Asia-Pacific ASP market in 2000.

This will decrease over the years but will represent more that 50% of the whole Asian-pacific market for some years to come.



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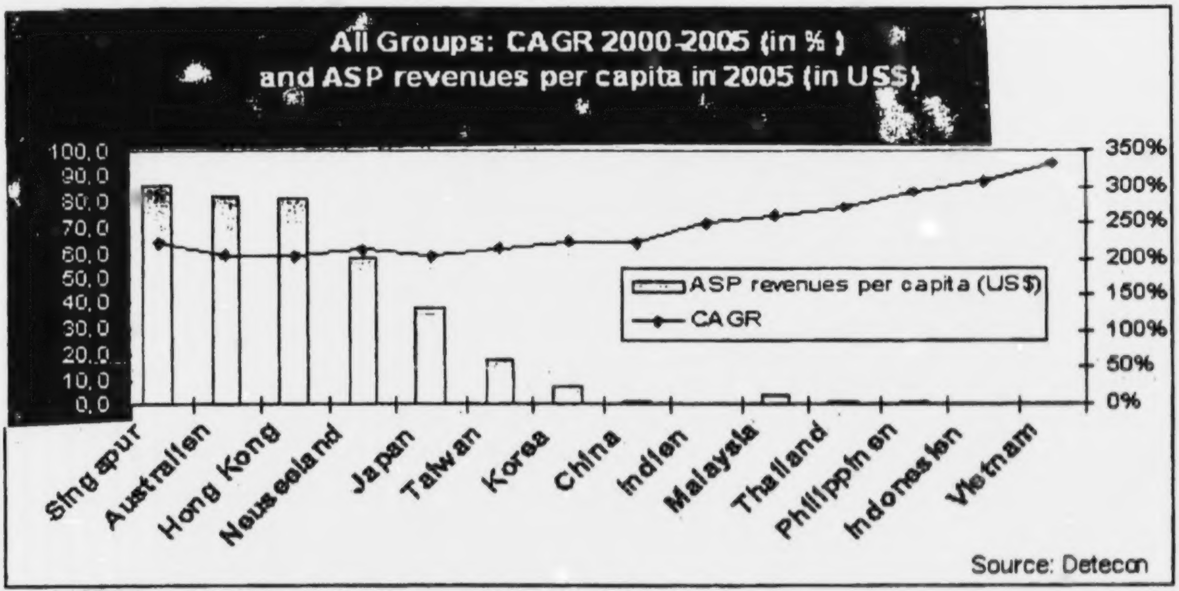
Each country in Asia has its own market expectations but three groups seem to follow distinguished growth patterns.

In **Group 1**, which includes Japan, Australia, Hong Kong, Singapore and New Zealand, ASP revenues already reach a relatively high level. The average CAGR between 2000 and 2005 will be around 200%. The ASP revenues per capita range within US$ 38 per capita in Japan and US$ 86.5 in Singapore.



Source: Detecon

In **Group 2** there are Taiwan, Korea, China and India. This Group reaches small ASP revenues and the CAGR is higher than 215%. China will have the 3rd-highest ASP revenues in 2005, but their ASP revenues per capita will only reach US$ 0.5 per capita because of its strong population.

Group 3 includes Malaysia, Thailand, the Philippines, Indonesia and Vietnam. These countries have very low or no ASP revenues so far. But with CAGRs higher than 250% these markets will be of growing importance in the future. The ASP revenues per capita will range from US$ 0.1 per capita (Vietnam) to US$ 3,4 per capita in Malaysia (in 2005).

Group 1:

Japan, Australia, Hong Kong, Singapore and New Zealand

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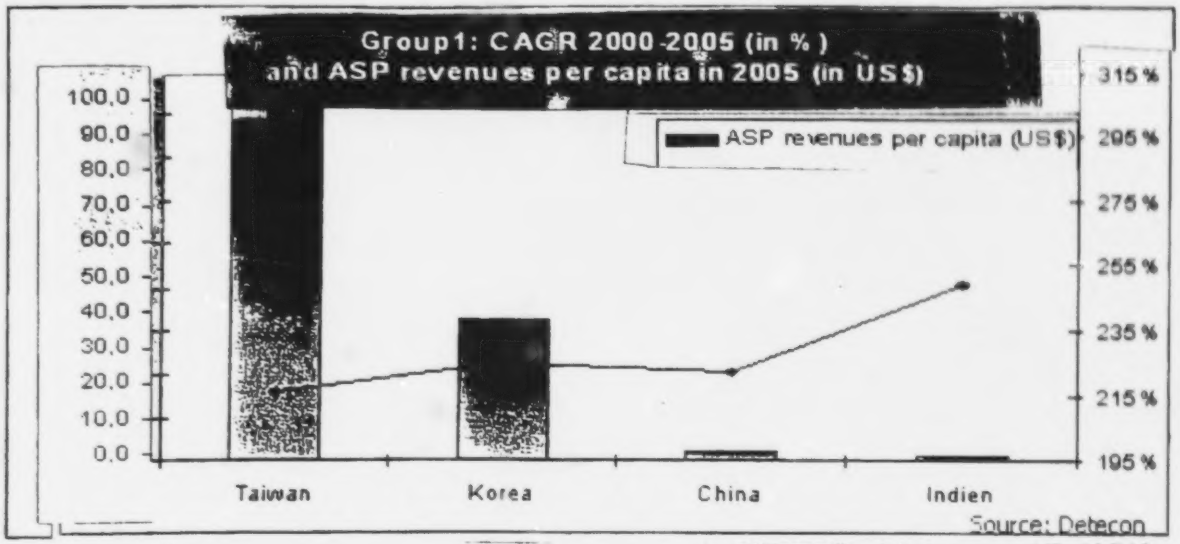

Source: Detecon

Japan, with revenues of US$ 132 Mio. in 2000 and US$ 4.77 Bln. in 2005 (CAGR 205%), is far the most important country for Application Service Providing in Asia during short and medium term.

Japan´s market share will decline from (59.1% in 2000 to 52.4% in 2005), but it will still represent more than half of the market´s revenues in Asia.

Australia´s ASP revenues will increase from US$ 39 Mio. in 2000 to US$ 1.49 Bln. in 2005 (CAGR 207%) and Hong Kong´s will rise from US$ 14 Mio. in 2000 to US$ 511 Mio. in 2005 (CAGR 205%).

Singapore´s revenues will climb from US$ 5 Mio. in 2000 to US$ 268 Mio. in 2005 (CAGR 222%). It has with US$ 86,5 the highest ASP revenues per capita. New Zealand increases from US$ 4 Mio. to US$ 202 Mio. (CAGR 214%) and has revenues per capita of US$ 57.7. Market shares remain generally unchanged (from 2% to 2.2%).

Group 2:

Taiwan, Korea, China and India

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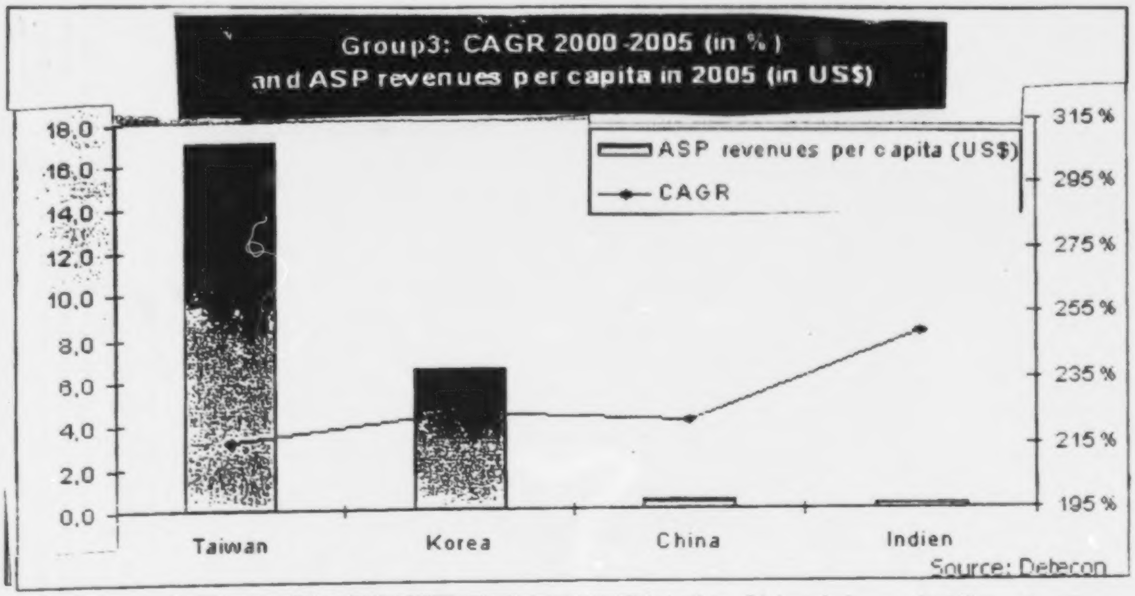

Source: Detecon

In the long-term, China and India will be important markets for ASP in the Asia-Pacific region. China, with revenues of US$ 12 Mio. in 2000 and US$ 597 Mio. in 2005 (CAGR 222%) it will be place 3rd in the market by 2005 (2000: 4th place). Its market share will climb from 4.9% to 6.6%.

India´s revenues climb from US$ 2 Mio. to US$ 192 Mio. ASP revenues per capita will stay small (US$ 0.2 in 2005)

Taiwan´s revenues per capita will reach US$ 17.1 in 2005 and Korea´s US$ 6.5. Their revenues are expected to climb to US$ 368 Mio. and US$ 449 Mio. in 2005 and their market shares to increase from 3.5% to 4% and 3.5% to 4.9% respectively.

Group 3:

Malaysia, Thailand, the Philippines, Indonesia and Vietnam

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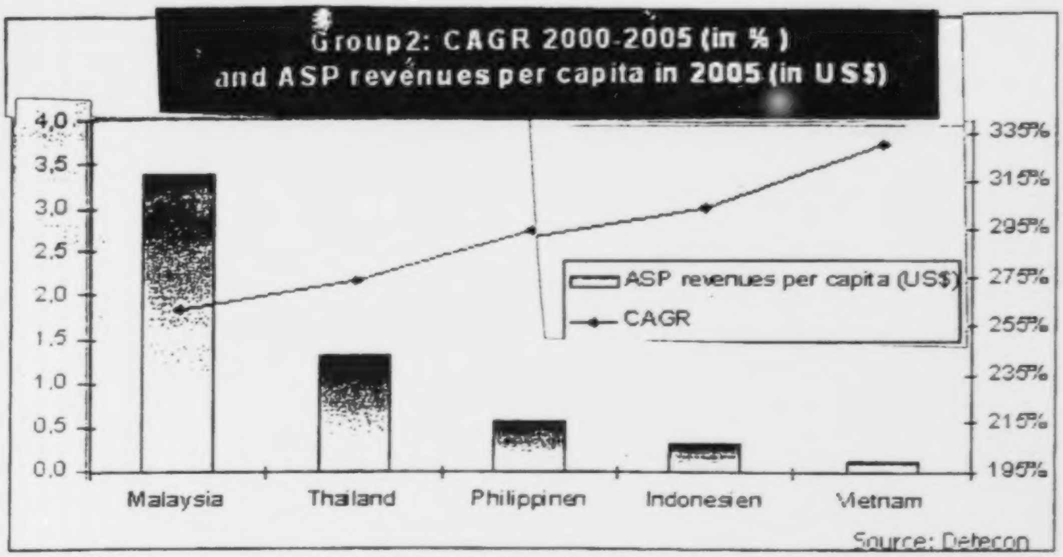

Source: Detecon

The countries in this group will emerge the fastest, with CAGRs between 258% (Malaysia) and 332% (Vietnam).

Indonesia´s CAGR of 310% will give this country a 3rd place in this group for their ASP revenues in 2005 (US$ 63 Mio.), but because of the high population (appr. 197.6 Mio. inhabitants) the revenues per capita are rather small at US$ 0.3.

It is to be expected that in the long-run (e.g. 10 years) even the smallest country in this region will have sizeable ASP markets. Therefore interesting market opportunities exist for the whole region especially as ASP services can (technically) easily be provided across country boarders.

3. Players and their capabilities and skills; what does it need to be a successful ASP

To look at the necessary capabilities and skills to be a successful ASP the business models for ASPs [4] need to be differentiated:

Business ASPs

provide mainly pre-packaged application services in volume to the general business market, typically targeting small to medium size enterprises. These are usually basic services e.g. e-mail services but may include managed services.

Enterprise ASPs

typically deliver a selected range of high-end business applications, supported by a significant degree of custom configuration and service. They provide applications which serve a specific professional or business activity, such as customer relationship management, human resources or Web site services (also called Specialist-ASPs).

Vertical Market ASPs

provide solutions tailored to the needs of a specific industry, such as the healthcare industry.

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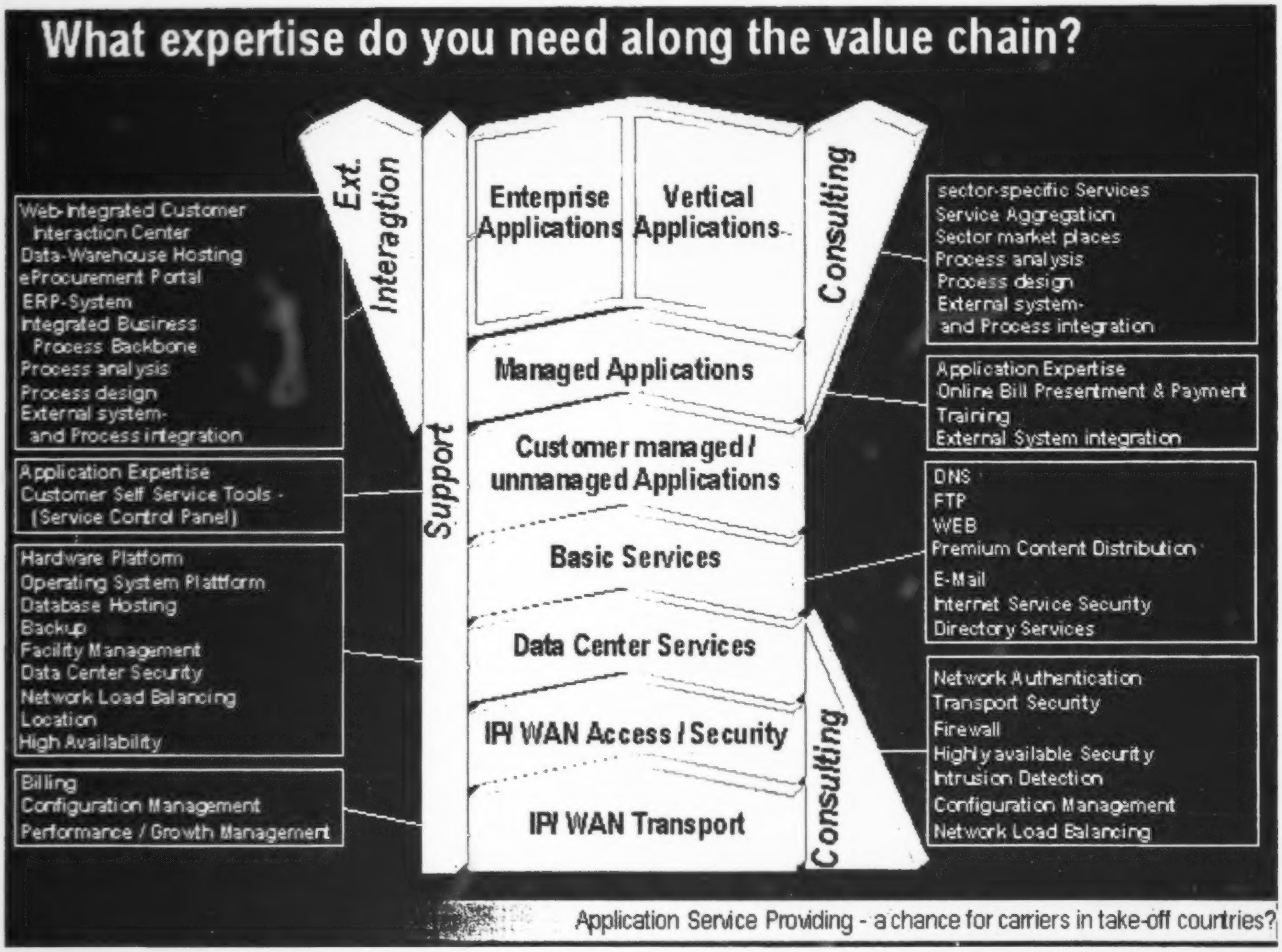
"Enterprise ASPs" and "Vertical Market ASPs" aim higher at the value chain of Application Service Providing than "Business ASPs", but all need data center services as well as access/security and Transport to provide their services.



What expertise do you need along the value chain?

Web-Integrated Customer Interaction Center
Data-Warehouse Hosting
eProcurement Portal
ERP-System
Integrated Business Process Backbone
Process analysis
Process design
External system- and Process integration

Application Expertise
Customer Self Service Tools - (Service Control Panel)

Hardware Platform
Operating System Plattform
Database Hosting
Backup
Facility Management
Data Center Security
Network Load Balancing
Location
High Availability

Billing
Configuration Management
Performance / Growth Management

Ext. Interagtion

Support

Enterprise Applications

Vertical Applications

Managed Applications

Customer managed / unmanaged Applications

Basic Services

Data Center Services

IP/ WAN Access / Security

IP/ WAN Transport

Consulting

Consulting

sector-specific Services
Service Aggregation
Sector market places
Process analysis
Process design
External system- and Process integration

Application Expertise
Online Bill Presentment & Payment
Training
External System integration

DNS
FTP
WEB
Premium Content Distribution
E-Mail
Internet Service Security
Directory Services

Network Authentication
Transport Security
Firewall
Highly available Security
Intrusion Detection
Configuration Management
Network Load Balancing

Application Service Providing - a chance for carriers in take-off countries?

That gives carriers a chance as they have plenty of capabilities and skills in the area of access, transport as well as data center services. How far up the value chain a carrier should provide services mainly depends on already existing internal capabilities and the carrier's available resources. Companies other than carriers realise the opportunity and are trying to enter the ASP market, too. Five categories of companies can be distinguished,

- **Web Software Vendors**
- **Service Aggregators**
- **Full Service Providers**
- **Application Infrastructure Providers**
- **Pure play ASPs**

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Web software vendors are software companies that have recently begun to reposition or establish their businesses to provide further ASP capabilities. Traditional vendors view the ASP model as another way to build revenues. The ASP model for newly founded companies has been the foundation of their growth strategy from their inception. Web software vendors usually partner with data centers and network providers to handle the back end part of their offerings.

Service Aggregators arrive from the consultancy and system integrations market. These companies typically deliver, implement, and manage a variety of applications, including ERP, CRM, and e-commerce applications. Their far reaching experience in system integration makes them ideal partners for some Web software vendors and ISPs (Internet service providers) who may have strengths only on the hosting side.

Full Service Providers This category mainly includes companies who offer both the front end and back end as part of their solution. These companies typically have mostly invested in their infrastructure and praise their high quality of service, reliability, and technical expertise on a range of applications. These companies also run their own data centers with the promise of providing their customers with a higher level of security and reliability. Dedicated customer care teams and end-user training services should also be part of any Full Service Providers offering.

Application Infrastructure Providers have traditionally focused on the back end of management and operations. For example, companies that specialise in deploying and managing data centers or have their roots in Web hosting or telecommunications can be considered Application Infrastructure Providers. These companies already have an infrastructure in place, large customer bases, and the geographic reach to extend the ASP model to a global scope. While not all of these companies have core competencies in application hosting and management, all would like to re-position themselves as serious players in the ASP market.

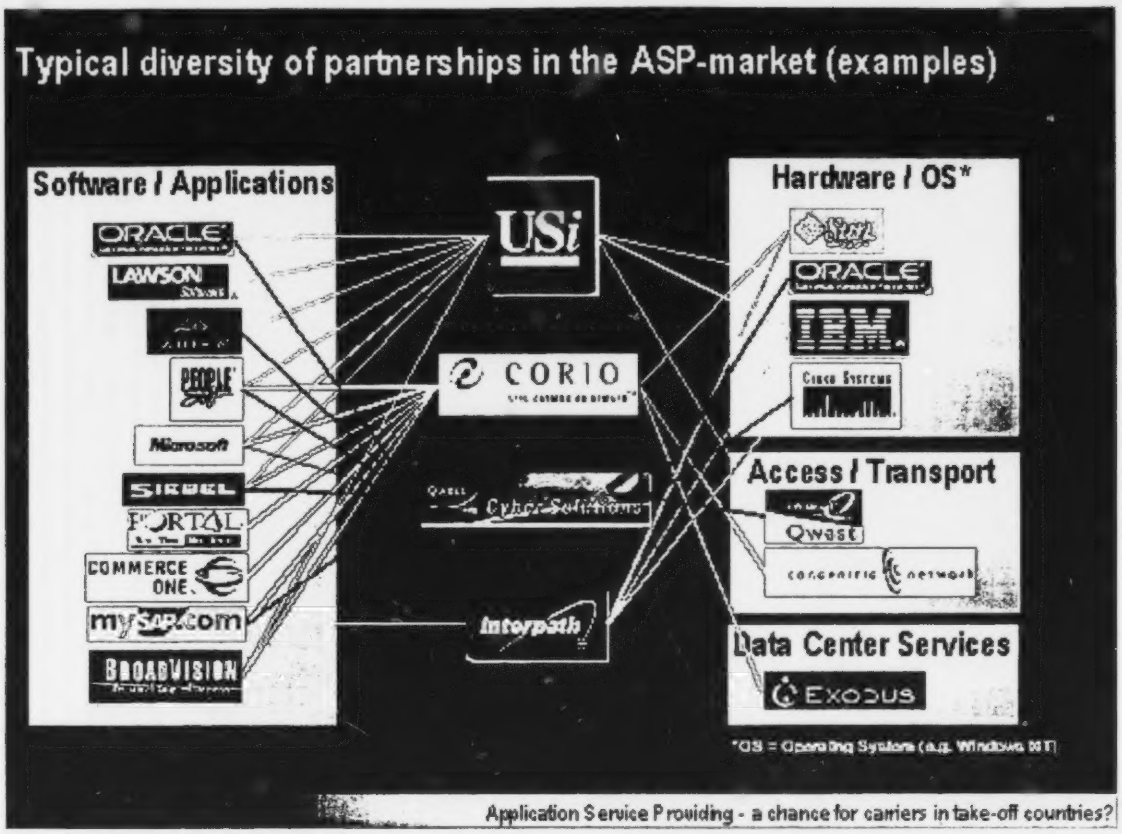
Pure Play ASPs are companies who either develop their own ASP applications or compose packages using applications from several other software vendors. These software packages often contain high-end products like ERP or CRM applications, but also standardized LotusÓ or MicrosoftÓ products. In contrast to Web software vendors, Service Aggregators and Full Service Providers, Pure Play ASPs only offer enterprise applications and do not operate data centers or communication networks. Their strength is the ability to react flexible towards specific customer´s expectations by rapidly offering new products and product lines. Pure Play ASPs often lack developed distribution channels and have insufficient financial resources. It is expected that Pure Play ASPs are going to play a role either as partners for other companies or in covering niche segments.

The **key success factors for the ASP market** are the **vertical skills** (skills along the ASP-value chain), which are required to combine the different layers to a successful product.

Examples are: Directory Systems Expertise; (administration and co-ordination of the directory system) or Technical Management (fine tuning of the technical performance).

The smooth integration of all layers into a single product is already quite a subtle task if it has to be done within one company. If more than one company is involved, the task increases in difficulty. But the core competencies of most players entering the ASP market are rarely integrative skills. Usually their strength lies in one or two layers of the ASP value chain. So some companies try to build up the necessary ASP skills in-house, but this requires plenty of management resources, large amounts of money and time.

Alternatives means to developing ASP skills are through joint-ventures, partnerships or the purchase of other companies. Currently, the growth of the ASP-market is only dwarfed by the number of ASP-partnerships, between carriers, software vendors, system integrators, ISPs, pure play ASPs and consultancy companies. Only a few partnerships so far have performed well. There are even signs that partnerships announced in the early stages will never be implemented. This is because of competition in certain areas which have not been of importance at the time a partner was chosen or simply do not work because of cultural or financial problems.



Typical diversity of partnerships in the ASP-market (examples)

Software / Applications
ORACLE
LAWSON
PEOPLESOFT
Microsoft
SIEBEL
PORTAL
COMMERCE ONE
mySAP.com
BROADVISION
USi
CORIO
Qwest Cyber.Solutions
Interpath
Hardware / OS*
Sun
ORACLE
IBM
Cisco Systems
Access / Transport
Qwest
concentric network
Data Center Services
EXODUS

*OS = Operating System (e.g. Windows NT)

Application Service Providing - a chance for carriers in take-off countries?

Although joint-ventures and partnerships are attractive for a quick market entry, a successful partnership requires a thorough screening of potential partners and takes time to be implemented.

4. What are the opportunities for carriers in take off countries in the ASP market?

In addition to skills in data transport carriers have, experience in system integration, operation & maintenance of data centers and distribution knowledge. But how far these skills are developed depends very much on each individual carrier: Larger carriers have sufficient financial and personal resources to build the necessary data centers, whereas smaller ones do often not. However, all carrier have two main ways to gain from the ASP market opportunity:

1) Carrier as enabler of Application Service Providing

The carrier only offers services at the back-end of the value chain, which would be either only IP/WAN Transport or additional services like IP/WAN Access / Security or also Data Center Services.

By building up capabilities and skills higher up the value chain (but only in so far as this is necessary to interlink its services with that of an ASP to a successful product) the carrier would profit from specialising in those layers where obviously its core competencies are.

Partnerships with application providers would be much easier as in this case carriers do not compete with ASPs in their field of business.

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The risk is, that a carrier might lose its customer contact and probably make itself exchangeable. As the competition in the back-end area is more intense than in the top segment its margins are lower. Nevertheless, it is possible to make extra profit as enabler of ASPs.

2) Carrier as Application Service Provider

Carrier also have the opportunity to benefit directly from the ASP business. They could offer services over the whole or large parts of the value chain. Carriers would have to improve their skills in parts of the value chain which have not been covered by their business. This would require personnel and financial resources, as well as time.

An advantage is the chance to participate in a new market with exceptional growth rates, while remaining in close relationship with its customers.

This not only takes time and resources to build this new branch of service, it also requires flexible structures which carriers often lack. They also have to establish their ASP brand and market presence. Competing with ASPs can also give a carrier problems in winning them as customers for back end services.

An example of a carrier as Application Service Provider in the Asia-Pacific Region - SingTel MagixÓ

SingTel is a leading info-communications company in the Asia-Pacific. Its turnover and net profit in 1999/2000 were S$4.87 billion (US2.86 billion) and S$1.85 billion (US$1.09 billion) respectively. SingTel is Singapore's largest company in terms of market capitalisation (about US$22 billion), and is listed on the Singapore Exchange.

SingTel´s subsidiary SingTel Magix is the first commercial ADSL (Asymmetrical Digital Subscriber Line) deployment in the world and was officially launched as a nation-wide service on 15th November 1997. ADSL Technology enables SingTel Magix to stream real-time videos, transmit huge amounts of data and access music videos via existing telephone line without causing interference. As an integral part of the Singapore government's IT initiative SingTel Magix represents a premier brand of services offered online and on-demand to homes, business, institutions and schools 24 hours a day.

SingTel Magix has offered since March 2000 ASP services in cooperation with Exent Technologies Inc., a subsidiary of Exent Technologies Ltd., one of Israel´s leading developers of software products for use in advanced telecom and broadband services like Applications-On-Demand (AoD) technology that delivers computer software programs over IP networks.

SingTel Magix already provides access to more than 100 educational CD-ROM titles. These are stored on their servers for Education-On-Demand (EOD) purposes. Also available is software concerning business productivity programs or entertainment and games.

It is too early to say if SingTels ASP venture will be successful but it shows that major Asian telcos see the market potential and try to address it.

What should/can Telcos do

The ASP-market is certainly a chance for carriers in take-off countries where the market is just developing. However, carriers have to act fast, and to be successful in this market they need to:

- Evaluate themselves thoroughly and honestly (ASP-SWOT)

- Evaluate the legal framework concerning ASP and the underlying network services
- Evaluate the market potential in the relevant area for the next 5 years
- Analyse existing and possible future competitors/partners in all parts of the value chain
- Agree on their long- term positioning (as ASP vs. as enabler for ASPs)
- Add the necessary capabilities and skills
- Built partnerships and a product portfolio

Carriers have significant skills, giving them the opportunity to play a leading role in the ASP business. In such a dynamic market only the flexible and fast acting companies will be able to secure a successful, long term market position.

5. Summary

Application Service Providing is certainly a chance not only for highly specialised ASPs and Software Vendors, but also for carriers. This is true all the more in take-off countries as the market is just starting to emerge and carriers have the technical knowledge as well as the financial resources to play an important part in this new market.

Carriers have two main routes to gain from the ASP market opportunity:

- as a company which offers ASP-Solutions (i.e. opening a new branch of business and co-operating with software and/or integration partners) and
- as an enabler of ASPs (i.e. mainly offering network and hosting solutions).

The successful positioning depends on existing capabilities and skills, the available resources, the legal framework and the expected market development in the relevant area as well as expected moves of competitors or partners. The necessary decisions will have to be taken soon.

Both suppliers and enablers of ASP services can be successful, but carriers which do not address the market risk losing out on a substantial revenue stream and take the risk of losing their most important asset, which is their direct customer access. Because ASPs will become the intermediary between carrier and customer, a carrier (especially one who has not developed the necessary skills for being a preferred partner/enabler) risks losing part of its core business (providing access to companies) in the long run.

Endnotes:

[1] **IT- outsourcing:** Transfer of internal IT infrastructure/hardware, personnel and applications

[2] **IP/VPNs:** Virtual Private Networks via Internet Protocol

[3] **Source:** Detecon www.detecon.com

and Ovum Research (March 2000) www.ovum.com

[4] **Source:** Detecon www.detecon.com

and Internet Research Group (February 2000) www.irgintl.com

Further sources:

1. SingTel-Homepage www.singtel.com
2. www.ASPnews.com
3. International Data Corporation (IDC) www.idc.com
4. International Communication Union (ITU) www.itu.org

Glossary:

ADSL: Asymmetric Digital Subscriber Line

AoD: Application-On-Demand

ASP: Application Service Providing

CAGR: Compound Annual Growth Rate

CRM: Customer Relation Management

EoD: Education-On-Demand

ERP: Enterprise Resource Planning

IP/VPNs: Virtual Private Networks via Internet Protocol

ISP: Internet Service Providing

IT: Information Technology

LAN: Local Area Network

SWOT: Strengths, Weaknesses, Opportunities, Threats

WAN: Wide Area Network

24/7: 24 hours a day, 7 days a week

Back to top of page **Back to the sessions page**

Jochen Dinger

Jochen Dinger is currently a Senior Consultant at Detecon GmbH. After studying at the University of Bristol and the University of Konstanz J. Dinger in 1995 received his Master Degree in Economics at the University of Konstanz, Germany.

Mr. Dinger has more than 5 years of experience in the telecommunications sector with specific focus on the IP as well as ASP markets, interconnection, pricing and quality of service. He worked for numerous European operators, the EU commission as well as operators overseas.

His area of expertise is the development of IP / ASP market strategies, market forecasts, pricing and quality of service strategies as well as interconnnection negotiations.

More recently, he is working on new requirements for Network Services through recent developments in the content & application sector.

His current responsibility at Detecon is that of a project leader in the above mentioned areas.

Back to proceeding page   **Back to the sessions page**

The ABCs of Being a CASP

Keith J. Rhea

Abstract

www.ipx-inc.com
www.tportal.net

Traditional and emerging telecommunications companies are competing on soft ground, the traditional calling minute. While the basics of economics apply by increasing demand as the price drops, the two trends do not offset one another. Quite simply price is dropping far faster than demand is increasing.

To place this into prospective a wholesale carrier that is generating $100 million in arbitrage revenue today is moving approximately 69 million minutes a month, if we use a $0.14 US as the price of an average minute. To understand the impact of the next few years, lets assume that average wholesale prices drop to $0.05, the resulting volume of minutes necessary to sustain the $100 million in revenue would have to increase to 166 million minutes per month. This is a 64% decrease in price that requires a 240% increase in volume to remain status quo.

So what do companies do? Let's lay out the choices. Open a wholesale operation in a foreign country, establish some directs to high margin counties, merge or acquire other companies for their volume, launch VOIP to reduce operating costs, milk the business until it withers, launch a prepaid card, enter the local exchange market, offer a retail calling product to small to medium enterprises, raise equity or debt to fuel some grand expansion plan, or find other things than minutes to sell.

The typical reaction to deregulation is to attach the embedded minute base of the incumbent carrier. This sustains new entrants nicely for several years since it is a fact that the incumbent will loose 30 to 40 percent market share in the first few years of deregulation to the emerging competition. The statistical generality of 80/20 applies to this market share however, 80 percent of the competition will account for 20 percent of the market, the remaining market is held by the incumbent and usually one or two large carriers that step in to assume a strategic hold on 10-15% of the market as the second dominant carrier.

Oddly enough what is not attacked by most competitors are the many other services that the incumbent offers. These include VPN services, Conference Calling, Unified Messaging, Class 5 switch services such as Centrex that include voice mail, etc. Typically a few companies reach out and touch this area with competitive services and quietly enjoy significant margins.

Why don't more companies offer these services? Initial investment is high, the market is smaller, the technology is specialized, the time to be operational can be significant, the marketing and sales is more complex, and ignorance.

But, let's clear through these issues and look at a few basic economics. A dollar of wholesale minute's revenue has a cost of goods sold in the neighborhood of 90%. After operational related costs the gross margin ends up being around 6-10% depending on the efficiency of the organization. With this 6-10% the organizations SG&A costs have to be covered and by the time the bottom line rolls around the positive number is not overly impressive.

Let's look at the mature service of conference calling. A dollar of retail revenue has a cost of good sold of around 10% and after operational costs, the gross margin is 60-78%. Sounds good doesn't it? But to obtain these margins requires significant investment and operational overhead that eat at the margin very fast.

This is why there aren't more companies selling conference calling. Frankly, it is too large of an up front investment, the technology is complex, and the sales process is completely different, usage is low, variable and infrequent.

Here are some trends in the market size and growth for some enhanced services.

- Unified Messaging revenue is expected to experience over 40% growth through 2006 according to Ovum Research, 1999
- Conference calling has been growing and is expected to continue growing at an average 20% per year from 1993 through 2001, according to Frost and Sullivan.
- Collaboration is expected to grow from virtually nothing to more than a $1.5 billion market in the US by 2003.

While the market and margins looking attractive, lets turn to the operational and marketing issues. The average implementation time for an enhanced application from plan to general availability is six to nine months. With persistence a company can build one of the systems and be successful. But during this time competition will undoubtfully increase, price wars will begin and consumers will begin to become more educated in their buying.

A wise alternative is to buy the service wholesale and offer it retail. Gross margin will drop to around 30% but you have no risk, no up front investment, and little additional operational overhead. Clearly this is the way to go.

If you want to be in the enhanced application business you are best off moving fast. Time to market will be a key to success. By reselling someone else's services, you are reducing your time to market, building a customer base, and when or if the time is right you can bring the solution in house. The speed to the market is a key factor to success.

Change at the Speed of Thought

Internet technology is radically altering the way every industry is managed, not just telecom. The clichés of rapid change, emerging markets, learning curve, leading edge, world class, global, etc., etc. just don't mean anything anymore. The world has become so advanced that only thoughts are moving nearly fast enough to harness a fraction of the power.

The world is faced with a growth rate in every segment of every industry that is unparalleled, unprecedented and exponentially larger than any market occurrence, ever. Technology breakthroughs affect our lives but never before has anything other than perhaps electricity, the printing press, and radio have affected world power, global finance, international trade and simultaneously place unlimited capabilities in the hands of the individual. This is not about rapid or exponential growth, this is about growth at the speed of thought.

To be successful in such an industry, focusing on competencies is a survival skill. In order to focus you need to have partners with complementary competencies. Your partners need to be available at the speed of thought.

To partner at the speed of thought you need a new way of doing business. You need "plug and play" partners, wthout the plug, because even the plugging wastes time. You need to THINK AND PLAY!!

The Instant Service Model

The traditional product management process has to be restructured from the linear phases of Concept, Design, Test, Introduction, and Growth to simply Concept and Grow. But the associated risk minimization of the initial phases has to be maintained so that new products and services are not plagued with poor quality.

Combine the speed of thought deployment with the complexity of constructing Internet products and services and you have a paradox: How to deploy complex services to a global retail or wholesale market in a quality manner within minutes of thinking of them. This is called Instant Service.

Assuming that you can achieve speed, it must be a balance with fitness for use. Quickly producing something that no one uses in not the best basis for business. The solution, product, and service must fit the needs of a single user now, and must be able to change instantly as those needs change. This is UNI-SEGMENTATION or THE MARKET SEGMENT OF ONE; a customized offering that is mapped to evolve continuously with the needs of a user.

T-Portal - The Next Edge Enabler

For telecommunications products and services, T-Portal solves the paradox. T-Portal is the first cross industry collaboration uniting hardware manufacturers, software providers, service providers, access providers, and application providers to radically change the way Internet related communication services are deployed around the world.

T-Portal is not a company; it is a collaborative concept. T-Portal is not a center or facility; it is a presence. Tportal is not global; it is ubiquitous. T-Portal is not a co-location facility; it is a no-location virtuality. T-Portal is the first and only presence dedicated to spreading the value of Internet based communication products and services and technology to everyone everywhere.

T-Portal's mission is to spread the benefits of leading communications applications to everyone everywhere.

T-Portal is an effort by leading technology companies to bring together complete advanced solutions to all areas of the world. The partners of T-Portal collectively are knocking down barriers that are slowing the use of technology. Ipx as the administrator of T-Portal is integrating many applications with a common provisioning, billing, and intelligence system. This allows ISPs, Carriers, Enterprises and other companies to have access to the technology instantly, with a right-sized infrastructure, without significant capital or resources.

The Application list

T-Portal offers applications such as the ones below.

Traditional Voice and Fax services.

Voice over IP

Unified Messaging (fax and voice mail to your email account)

Collaboration

Audio Conferencing.

Web fax services

SIP based IP Centrex

ECRM, Click to talk and call center enhancement systems

And many, many others, some not even conceived of yet....

A typical ISP or other service providers, such as a traditional phone company once connected to T-Portal, will have all these services available for resale to their customers within minutes of wanting to offer them. This would provide a rapid availability of these services to the population without the lengthy adoption period of each service provider having to build and operate their own system.

T-Portal is the largest industry cooperation across the various segments of products and services to expand the use of technology for benefit of the people. Each partner provides their solution and there is a wholesale pricing structure that allows any service provider to resell the services to their retail market. The companies participating or supporting T-Portal are 3Com, Cirilium, Motorola, iSoftel, IPX, Webtelecom, Webex, Exodus, Brooktrout Technologies, Sonus, Netspoke, and Voyant.

Connect now, deploy now, think always…the next edge is T-Portal.

For more information on T-Portal visit the website www.tportal.net.

Back to top of page **Back to the sessions page**

Keith J. Rhea

Mr. Rhea has spent over seventeen years of international experience in telecommunications ranging from voice and data services, satellite and cable, and enhanced internet based communications services. He has been successful in working with many cultures across all continents. He specializes in identifying and building markets, especially in Asia and Europe.

Functionally, Mr. Rhea has experience in marketing, sales, finance, operations and senior management with large companies such as AT&T, TeleDanmark, and Associated Press as well as smaller entrepreneurial companies such as UTG International, Pan Asia Telecom, and most recently IPX.

As the co-founder of ipx, a leading VOIP Clearinghouse, he has achieved amazing results and significant value for investors. He has led the company to develop an CASP (Communications Application Service Provider) model offering a broad set of communications services in a unique manner, achieving significant value for the investors. IPX has built a strong competitive model by focusing on simplifying the complexity of communications technology for people to use everyday.

Mr. Rhea received his MBA from Columbia University and his undergraduate degree received with honors is in Decision Sciences and Psychology from Georgia State University.

Back to proceeding page **Back to the sessions page**

New Advances in Network Operations Support Systems

Peter Barletto and **Michael Kelly**

Abstract

www.tycomltd.com

Introduction

Is there ever enough time in a day, or information available to make an informed decision? The future of Operation Support Systems (OSS) is developing a tool that bridges the time vs. information dilemma. Everyday we hear about convergence and it's impact on the telecommunications industry, nowhere is this more apropos than within the OSS. The guiding premise for the future of OSS is that all information must be available in real time, with the ability to take action across this same system either within the enterprise or by an external customer. Future networks are evolving to the point where the reliability of the network infrastructure is a given, and the robustness of the OSS becomes a competitive tool which can be leveraged by the network owner as well as the customers. This competitive tool is emerging as a new vehicle for customer retention, creating value by accessing existing customer data to provide comprehensive customer care. The value of this comprehensive customer care leads to improved customer satisfaction, thereby retention, and finally increased revenue per customer.

Today we begin to glimpse the future of the OSS with integrated software packages that encompass the various facets of the network including Network and Systems management, Service Development and Operations, and the Customer Care processes. The largest obstacle to the smooth implementation of an OSS is the requirement to integrate with legacy systems. The emergence and growth of numerous new telecommunications companies begs the question of whether advances in OSS have given 'green field" companies the leverage to accelerate their competitive position against their larger and more established counterparts. The systems and information that give established companies their edge, maybe the weight that holds them back in development of integrated solutions. New market entrants have an opportunity to develop a future proof solution with a short duration from conception to deployment. These new solutions may well become the electronic glue that bonds a customer to a specific global network. The amazing part about these solutions is that in reality you are creating value through the collation and presentation of data that has always existed within the network. The development of integration software aligned along business processes has shifted the focus to the why's of the networks existence. The flexibility afforded by this new generation of OSS becomes an enabler to new levels of customer satisfaction.

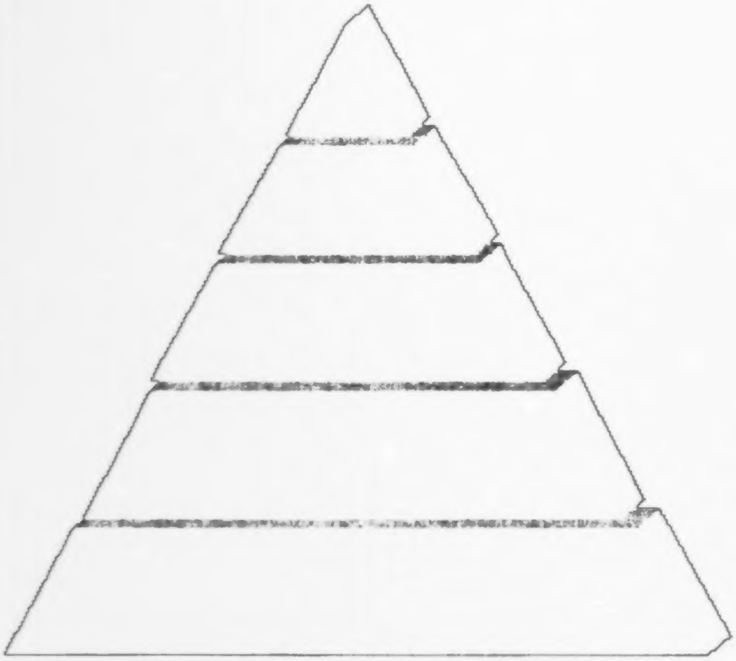
Alignment to Business Processes

It can be said that changes in OSS are leading many companies to change their internal culture. The OSS becomes an enabler in developing a customer-centric culture within the company. Until recently, we in the telecommunications industry have lived or died by our network-centric culture for quality and reliability of service, it was what our reputations have been built upon, and to many was a key differentiator in the marketplace. In today's market, quality and reliability are standard expectations and superior customer care across the entire enterprise is the differentiator. In a truly customer-centric company, a Customer Care Center becomes the conduit to delivering exceptional customer service, not the place where it happens. The emerging OSS is the tool that allows the "Customer Care Center" to reside with any individual within a company be it

Marketing, Sales, Finance, or Network Operations. Information is one of the levers that empower the team to deliver the exceptional customer service expected of the market. The OSS can have the flexibility to segment the market by company, providing individualized customer care in real time. Real time information at the click of a button shifts the strategy of customer care from defensive, to one of proactive support, which anticipates the needs of the customer. The Customer Care Center essentially notifying customers of problem resolutions before customers realize a potential problem existed!

Why suddenly has an OSS become this great enabler? The OSS is emerging as the enterprise resource planning (ERP) tool of telecommunications companies. ERP continues to revolutionize the way companies do business, by providing a single repository for information about a company and it's day to day operations. ERP eliminated "stove pipe" software applications, integrating such functions as finance, production, purchasing, personnel, and sales. Companies finally had a single view into the workings and inter-relationships of the various functional areas of their business. Similar to ERP, the OSS provides automated access across all facets of the network infrastructure as well as the business requirements that support it. The Telecommunications Management Network (TMN) model (*Figure 1*) of the ITU-T demonstrates how an effective OSS integrates, in a building block fashion, up through the various layers of Network Element, Element Management, Network Management, Service Management, and concluding with the Business Management Layer. The TMN model though simple accurately depicts the importance of each layer within the process to the overall success of the business. Expanding on the TMN model, the TeleManagement FORUM developed the Telecom Operations Map (TOM), employing the layer concept but expanding to encompass the idea of the customer-centric business (*Figure 2*). TOM inserts the additional top layer of Customer Interface Management, then carves down through the layers to define three customer-facing processes of Fulfillment, Assurance, and Billing. In any business, a large portion of customer satisfaction is measured by an ability to communicate and interact on the status and process of Fulfillment, Assurance, and Billing. An important note is that it is not only the successful completion of these processes, but sharing with the customer the process definition and status along the way to completion.

Figure 1: ITU-T, Telecommunications Management Network Model



The fact that this network and customer information resides in the common repository of the OSS enables all members of the team to share a common view. Members of the team can monitor in real time the performance of the key processes as well as customer interactions. The system allows team members to configure customized views for all of a customer's service, or to drill down into a specific service or interaction. No matter what team member a customer speaks with, they should here the one "voice" of the service supplier.

The importance of a single "voice" to the customer can not be understated. The "voice" can be defined as how we impart the goals or missions of the network provider to the customer. The customer must receive a consistent message as to when, what, and how of service delivery, as well as how this fits with the companies marketing message. Suddenly all employees become touch points with the customer and must be trained to convey a consistent factual message of network performance, as well as a consistent marketing message.

Figure 2: TeleManagement FORUM, Telecom Operations Map (TOM)

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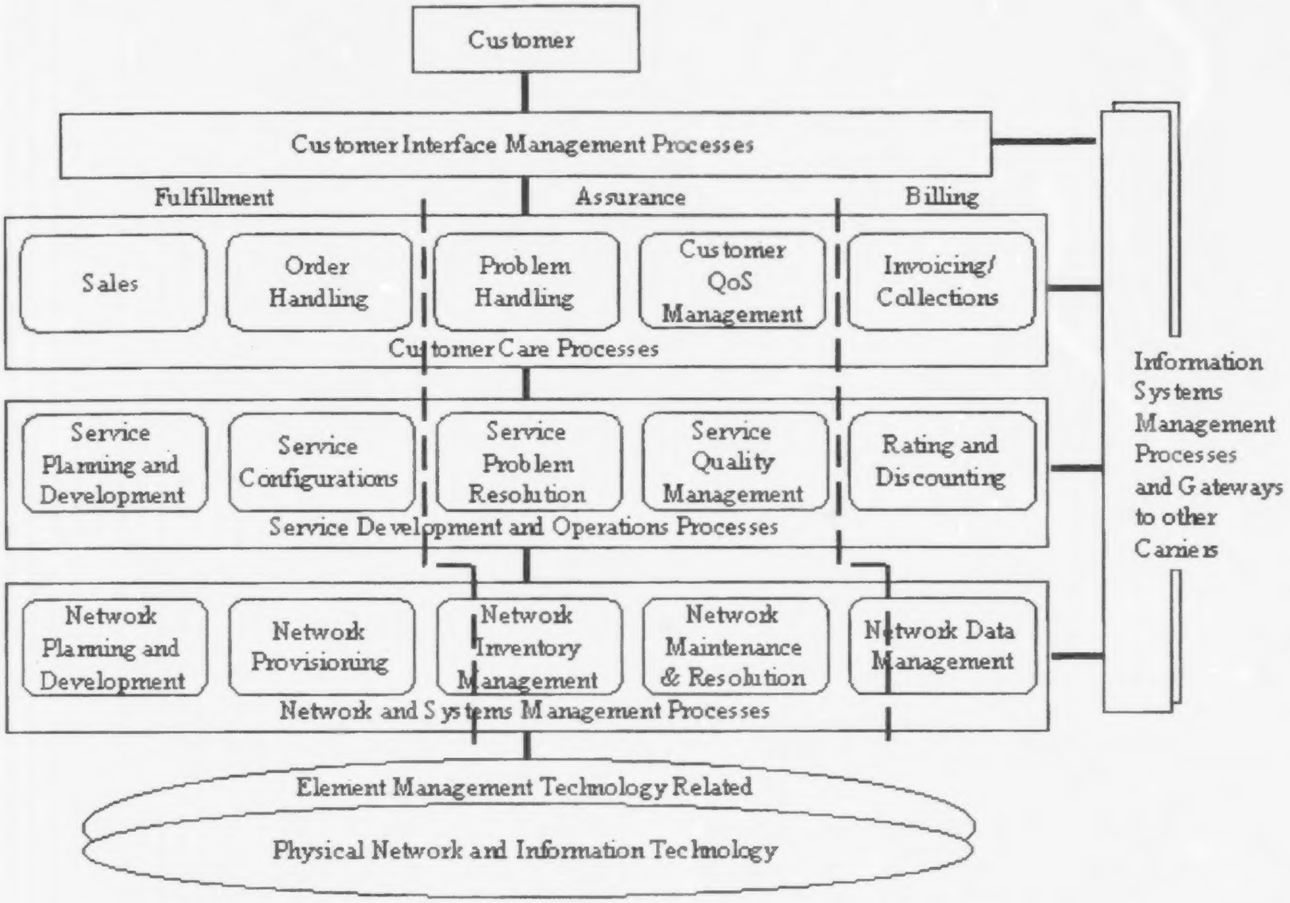
Customer
Customer Interface Management Processes
Fulfillment
Assurance
Billing
Sales
Order Handling
Problem Handling
Customer QoS Management
Invoicing/ Collections
Customer Care Processes
Service Planning and Development
Service Configurations
Service Problem Resolution
Service Quality Management
Rating and Discounting
Service Development and Operations Processes
Network Planning and Development
Network Provisioning
Network Inventory Management
Network Maintenance & Resolution
Network Data Management
Network and Systems Management Processes
Information Systems Management Processes and Gateways to other Carriers
Element Management Technology Related
Physical Network and Information Technology

Defining the Business

Whether a startup or an established company, the development of an effective OSS begins with defining the business processes. The TOM provides a basic roadmap by which to document the processes around which to build the OSS. As can be imagined, the process definition becomes a pivotal tool in the future success not only of the OSS, but also of the company.

The fifteen sub-processes of the TOM provide templates to prompt the user in development of network specific processes. The templates begin by defining the process, and what should be considered within scope. These templates further suggest Inputs and Outputs to be considered, first by Customer and then according to the other TOM sub-processes. Defining the business begins with the Sales sub-process and continues horizontally through the Customer Care Process. One of the advantages of this approach is that Subject Matter Experts (SME) usually can concentrate on a few consecutive sub-processes instead of being required for the entire business definition. The business definition exercise can take upwards of a month depending on the level of granularity expected to be developed. Human resources for this type project become difficult to retain, as usually several other concurrent projects within the company require the attention of your SMEs. The importance of complete participation across the company can not be emphasized enough; the utility of the OSS depends on the shared "view" of what, how, and when. All organizations Sales, Customer Care, Finance, and Network Operations must feel that the OSS addresses and resolves their concerns and needs. To be an effective tool, the OSS must become the glue that bonds your organization.

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As each horizontal layer of the TOM is completed, you move down through Customer Care, Service Development and Operations, and Network and Systems Management process layers. Using the Customer Care Processes as an example, starting with Sales and moving through Order Handling, Problem Handling, Customer Quality of Service Management, and Invoicing/Collections. Once the horizontal process flows are complete, we review the processes against the vertical flow-through processes of Fulfillment, Assurance, and Billing. The vertical processes of Fulfillment, Assurance, and Billing represent the flow-through of how the Customer connects, and interacts with the network. An example of Fulfillment would start with Sales, flowing through Order Handling, Service Planning and Development, Service Configuration, Network Planning and Development, ending with Network Provisioning. The two axis represent the different perspectives of the network, the horizontal representing the internal view and the vertical representing the customer's view. The melding of these two perspectives is the key to developing an OSS that becomes a market differentiator.

External Bonding and the Future

What does the future of OSS hold, and how will these systems bond customers with the suppliers? We are beginning to see the future unfold before us with the emergence of web based customer care. I think many people wrongly use the term "self care" for web based customer care programs, which currently provide only a fractional portion of their future potential. As OSS matures as a web enabled tool, customers actually become an integral part of the team, capable of pulling and pushing customized information tailored to meet the needs of their business. The key from the customer's perspective will be the seamless, real-time access to the same information being used by the service providers team members. Web technologies such as voice, video, and assisted browsing will give the customer the choices to directly engage with customer service representatives or technicians to answer questions, locate information, or develop solutions. Web enablement is not about reducing the size of a customer care staff, but giving the customer a choice to be an interactive part of the service delivery processes.

The OSS will be the vehicle that carries the interactive participation to new heights. We can only surmise what the future holds for OSS automation. Capacity purchased online and self-provisioned within minutes! Re-configuring existing circuits within minutes to meet changing demand in emergency situations! Your imagination is the only limit to what capabilities the next generations of OSS will provide.

Conclusions

We have seen a tremendous evolution of the OSS within the last few years, yet these are only the baby steps of a fledgling new tool. A tool which integrates the infrastructure building blocks, such as undersea and terrestrial cables and their associated transmission technologies with co-location facilities and server farms, to meet the customers needs through the three service processes of Provisioning, Assurance, and Billing. OSS will have many forms of delivery, from the traditional Customer Care Center to the customer's direct control over their portion of the network infrastructure. OSS's will have open access, capable of integrating various vendors supporting software and hardware, including other OSS. Closely integrated voice, video, and web channels enable on-demand customer care from anywhere on the globe. The ability to access all customer data in a single location, deliverable through multiple channels, providing market segmentation down to the individual level. This individualization leading to improved customer satisfaction and creating customer loyalty and retention.

The key to the future is flexibility! Having the infrastructure that allows you to personalize services down to the individual customer level. Creating value to the customer through comprehensive customer care achieved by the retrieval and presentation of data from a single repository. Internal value is created by the customer loyalty and retention achieved through this new level of service.

Convergence is upon us in many ways, but the road for Operations Support Systems is just beginning!

Back to top of page **Back to the sessions page**

Michael G. Kelly

Director - Customer Care Center
TyCom

Mr. Kelly has served as Director-Customer Care Center for TyCom since April 2000. Current projects include construction of TyCom's Customer Care Center in Bermuda, and defining business processes that drive the development and implementation of the TyCom Global Network Operations Support System. Previous positions with TyCom include Director-Regional Marketing, as well as three years as Director-Marine Operations. As a licensed Master Mariner with over fifteen years sea experience, Mr. Kelly has been Captain of numerous cable ships involved in the installation and repair of undersea cable systems. He has a BS in Marine Transportation from Massachusetts Maritime Academy and his MBA from Rutgers University.

Back to proceeding page **Back to the sessions page**

Country / Region

Monday, 15 January 2001
1100–1230

M.1.3 Latin America

Location: Honolulu Suite

Chair: JAGADISH RAO, Consultant, USA

M.1.3.1 Internet Growth Trends in Latin America (ABSTRACT)

THOMAS R. SPACEK, Executive Director, Internet & Global Information Infrastructure Initiatives, Telcordia Technologies, *USA*

M.1.3.2 AmPATH (ABSTRACT)

ARTHUR S. GLOSTER, Vice Provost & CIO, Information and Resource Management, Florida International University, *USA*

M.1.3.3 Internet Market Opportunities in Latin America (ABSTRACT)

FABIO FERREIRA KUJAWSKI, Counsel, Telecommunications, Public & Corporate Law and OSCAR PETERSEN, Carvalho de Freitas e Ferreira Attorneys at Law, *Brazil*

M.1.3.4 Will the US Infrastructure Build Pattern Repeat Itself in Developing Nations? (ABSTRACT)

PRAVIN JAIN, Vice President, Enron Broadband Services, *USA*

Internet Growth Trends in Latin America

Thomas R. Spacek

Abstract

www.telcordia.com

BACKGROUND

For many years, Telcordia has been heavily involved in measuring, monitoring and forecasting Internet growth and has an active research and development program performed by a multidisciplinary team of statisticians, economists, Internet engineers, and computer scientists all working together to enhance our unique measurement capabilities. Telcordia™ Internet Sizer estimates a variety of statistics related to the size and growth of the Internet, and we make many of these statistics publicly available (see www.netsizer.com). More advanced capabilities are not publicly available. Traditional methods for measuring, tracking, and forecasting the information economy are unable to keep pace with the speed at which the Internet economy changes. Often Internet measures are estimated once or twice per year and become quickly outdated, whereas we produce some outputs in real time, and others daily, weekly, or monthly. In fact by observing the "Internet growth clock" displayed on www.netsizer.com you can actually watch the Internet grow in real-time.

Telcordia Internet Sizer produces the number of hosts, users, and subscribers on the public Internet. Host counts are produced by domain (e.g., .com, .net, .cr), by geography (e.g., by country, region), by Internet Service Provider (ISP) and other major Internet players. Internet user and subscriber estimates are produced by geographic region. Our research program includes developing capabilities to measure activity on routers, servers, and network links (e.g., T1 lines). For example, such capabilities include measuring bandwidth and traffic on any network link accessible in the public Internet. The research program also includes developing capabilities to measure, monitor, and forecast Internet business activity within the emerging digital economy at the global, country, industry segment, and individual firm level.

INTERNET GROWTH IN LATIN AMERICA

Dramatic Internet growth continues in Latin America. Over the past year Internet users have grown from 7.6M to 13.5M. Over the past year Internet hosts have grown from 800K to 1.3M (see Figure 1). Note that an Internet host is an IP address, thus hosts include web servers, mail servers, modems in modem pools, etc.

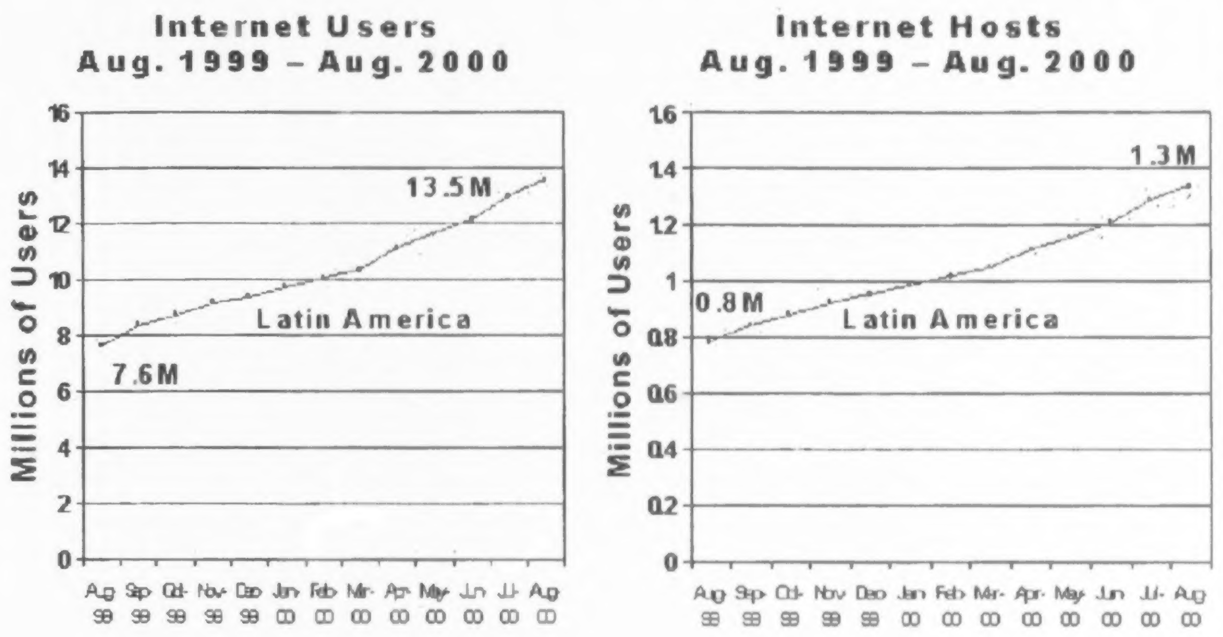
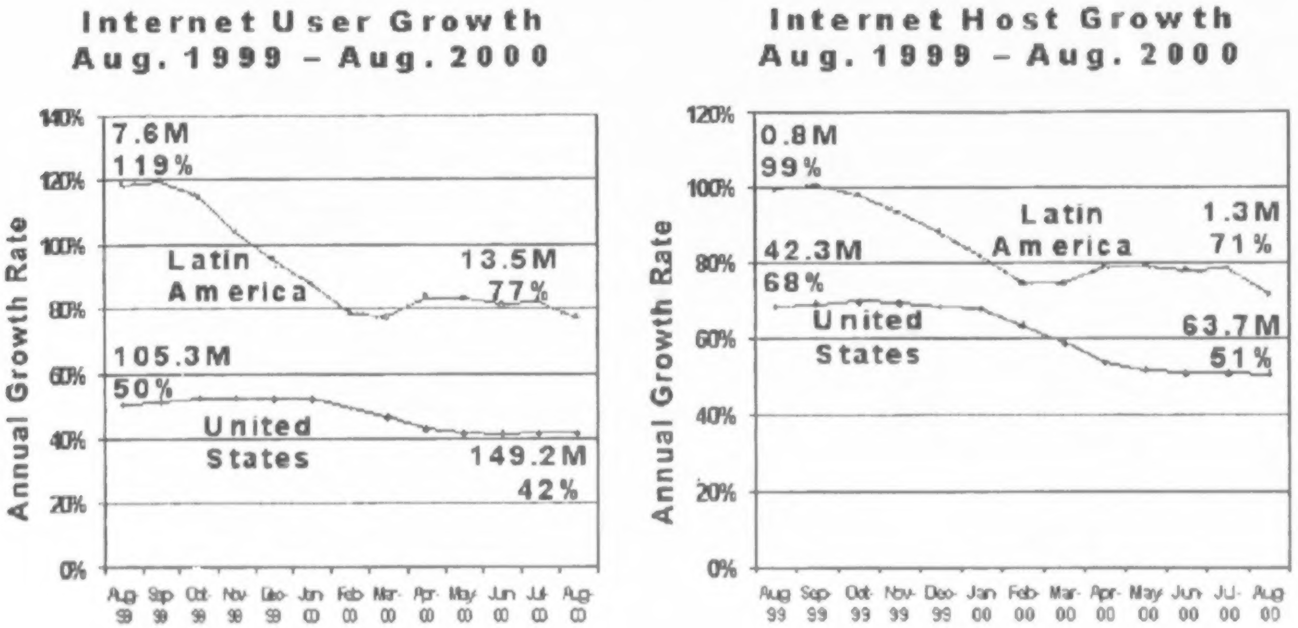


Figure 1 **Source: Telcordia™ Internet Sizer (www.NetSizer.com)**

Figures 2a and 2b show annual growth rates for Internet users and hosts respectively. Each point represents the annual growth rate from the same month in the previous year. As shown in Figure 2a, in the past year Internet users in Latin America have grown by 77%. Although the absolute number of users in greater in the US (149.2M vs. 13.5M in Latin America), the growth rate in Latin America (77%) is much greater than the US (42%). The high growth rate is encouraging, however to relate this to the issue of universal Internet access, only 2.7% of Latin Americans currently use the Internet, whereas 54% of people in the US use it. As shown in Figure 2b, in the past year Internet hosts in Latin America have grown 71%. Again, although the absolute number of hosts is greater in the US (63.7M compared to 1.3M in Latin America), the host growth rate in Latin America (71%) is significantly greater than the US (51%). Relating this to the issue of universal Internet access, there are only 3 hosts per 1000 people in Latin America, whereas there are 231 hosts per thousand 1000 people in the US. Note that in developing countries the number of Internet users per host is typically greater than it is in more developed countries. This is borne out in Latin America with 10.4 users per host as compared to 2.3 users per host in the US.



(2a)

(2b)

Figure 2

Source: Telcordia™ Internet Sizer (www.NetSizer.com)

In Figures 2a and 2b, the slowing growth rates in both Latin America and the US should not be of concern. First of all, although the rates are slowing, they are still very high. Also slowing growth is typical of service diffusion. Even with the still very high Internet growth rates in Latin America, there are many factors which can spur a new wave of growth such as emerging competition in the telecommunications industry in Latin America, ISP competition, the introduction of wireless Internet access with a very inexpensive device (compared to a PC), and network externalities. These factors will be discussed later in the paper.

Since host counts are more accurate than user counts, we will focus on host counts for six Latin American countries in Figures 3a and 3b. For each country the left bar is August 1999, the middle bar is August 2000, and the right bar is the estimate for August 2001. The numbers on top of the middle bars refer to the number of hosts and the annual growth rate in August 2000. As shown in Figure 3a, of these six countries Brazil has the greatest number of hosts with 512 thousand and Uruguay has the least with 35K, but note that Uruguay has the highest growth rate. From August 1999 to August 2000 hosts grew 113% in Uruguay.

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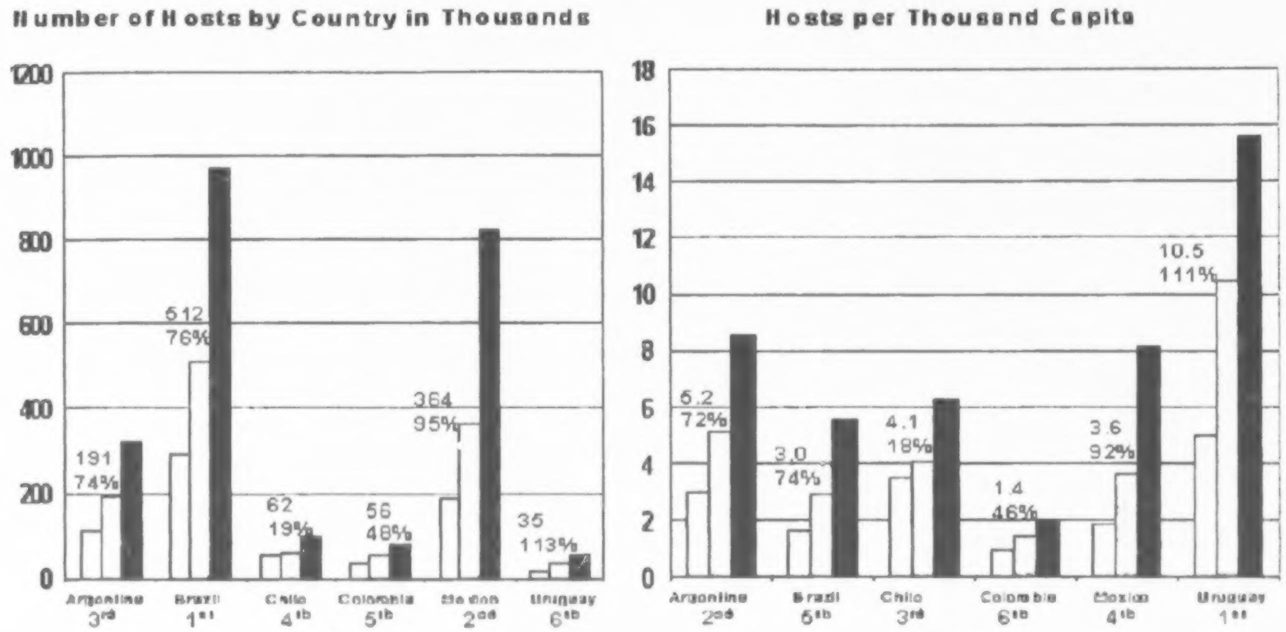
August 1999 – 2000 - 2001



(3a) *(3b)*

Figure 3 **Source: Telcordia™ Internet Sizer (www.NetSizer.com)**

Also note the high growth rates in Mexico (95%), Brazil (76%), and Argentina (74%). Although Uruguay was lowest in the absolute number of hosts (Figure 3a), the country is first in hosts per capita with 10.5 hosts per 1000 people (Figure 3b). It would be instructive to uncover the causes of the high hosts per capita and growth rates in Uruguay and how the causes may be related to government policies, the regulatory environment, the business, market, and competitive environment, etc. The country with the next highest hosts per capita is Argentina, then Chile, then Mexico. Also note the high host per capita growth rates in Uruguay (111%), Mexico (92%), Brazil (74%), and Argentina (72%).

KEY FACTORS IMPACTING INTERNET GROWTH IN LATIN AMERICA

Figure 4 depicts four key factors impacting Internet growth in Latin America. There is no simple formula for achieving growth to the point of, say 50% of the population accessing the Internet, since each growth factor both impacts and is impacted by the other growth factors. A fifth critical growth factor which, for the most part, is beyond the scope of this paper (we do discuss some aspects of wireless Internet access and Internet Network Access Points later), is the need for further development of the communications infrastructure.

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Factors Impacting Internet Growth in Latin America

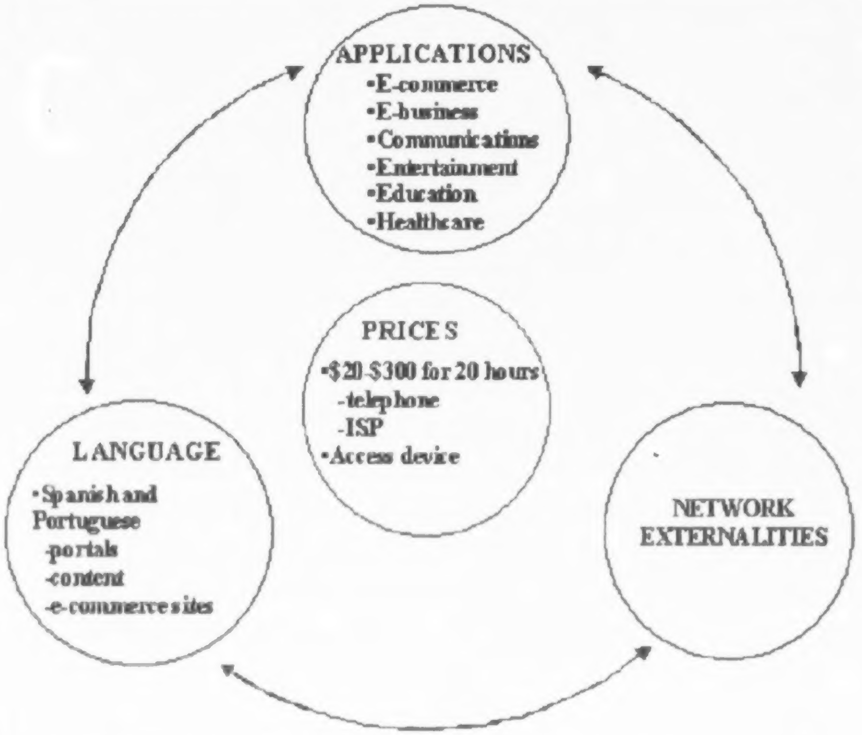

Figure 4

Applications

Increasing growth requires applications that provide sufficient value-added to businesses and to the population at large to make them both willing to pay for and willing to spend time on the Internet. Two of the major driving forces for the Internet's current and projected future growth are productivity improvements for businesses and government agencies, and electronic commerce -- both business-to-business (B2B) and business-to-consumer (B2C). Many Latin American companies are experiencing dramatic productivity improvements from using electronic business applications on both public and private Internet Protocol (IP) networks and the relevant applications will spread to many more firms. Similarly B2B electronic commerce is rapidly growing. Although B2C electronic commerce is growing rapidly in Latin America, it is hampered by several factors including the lack of secure payment methods (credit cards are not widely held in many areas in Latin America) and the lack of reliable delivery methods. However, these issues are likely to be resolved over time. In 1999 $US 192M in B2C electronic commerce was spent by Latin Americans, and they are projected to spend $US 8.3B by 2005 (Inter@ative Week, September 25, 2000). Another issue is that to date the preponderance of B2C electronic commerce spending in Latin America involves purchases from US sites. Electronic commerce growth is clearly impacted by issues discussed in the Language section below as indicated in Figure 4. Communications applications such as electronic mail, chat rooms, and instant messaging are popular and stimulate growth. Growth of these applications is tightly coupled to the Network Externalities factor also as shown in Figure 4 and will be discussed below. Another important application for mass-market growth is entertainment including games, music, videos, etc. Particularly valuable especially for providing important services to rural areas are distance education and telemedicine applications. Although the benefits of such applications can be of tremendous value and may help meet a country's societal needs, the applications come with a price and require a sustainable funding mechanism which in many cases may be beyond affordability levels when compared to other priorities.

Network Externalities

The concept here is that the more people that are connected to the network, the more value there is for each user. This is particularly easy to see for communications applications such as electronic mail. So when Internet penetration reaches a certain

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critical mass in Latin America (say 10% of the population, although studies would need to be done to find an accurate figure), there will often be a new rapid increase in growth.

Language

As noted at AHCIET's Internet 2000 in Santiago, Chile, there were about 2.6M Spanish web pages in 1999 which is less that 2% of the total. However, Spanish and Portuguese portals, content, and electronic commerce sites are proliferating. Having content in ones native language and having local content are key to increased demand for the applications discussed above.

Prices

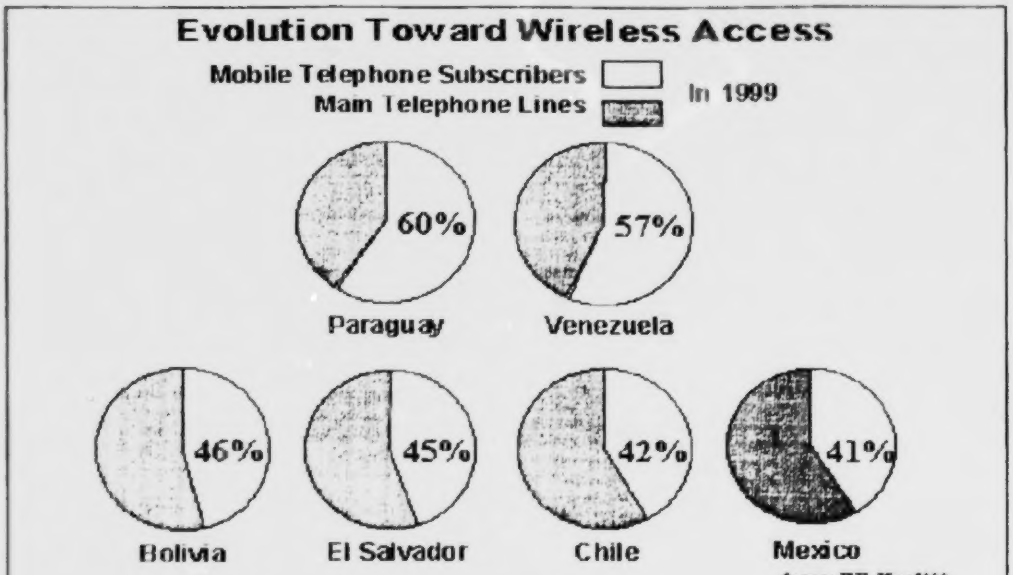
As noted in *Time* magazine, depending on where you are in Latin America it could cost between \$20 and \$300 for twenty hours of web browsing. The components of the price are telecommunications prices -- both fixed and usage-based -- and ISP prices which can be up to \$50 per month for dial up access. Another important factor is the price of the Internet access device which, for the most part today, is a PC. Many Latin Americans may not be able to afford the combined telecommunications and ISP rates mentioned above nor afford a PC.

TRENDS AND CHALLENGES FOR INTERNET GROWTH IN LATIN AMERICA

The telecommunications sector in Latin America has and continues to become increasingly privatized, de-regulated, commercialized, and competitive. Competition will likely lower telecommunications prices which will help spur Internet growth. There are flat or reduced telephone rates for Internet use in some countries which stimulate Internet growth. Competition among ISPs is lowering prices and spurring Internet growth. Free Internet access is emerging, e.g., catolico.com.br offered by the Catholic Church in Brazil. iG.com.br, also in Brazil, ran an advertising campaign and expected to attract 60K applicants for its free Internet service over three months. They actually received 940K applicants in two months. Free Internet service is also available in Argentina and three major cities in Mexico and is coming soon to Chile, Colombia, Ecuador, and Peru. Both free and paid Internet access will co-exist where the free service will typically be a low-end service supported by advertising. PC prices continue to decline which will spur Internet growth. Another growth stimulant is innovative marketing approaches that are becoming increasing available, e.g., bundling a PC with a multi-year Internet subscription contract. Spanish and Portuguese sites are proliferating which is a very positive sign for Internet growth. Although B2B will be larger, both B2B and B2C electronic commerce will be of major importance and will drive Internet growth. Government and, in some cases, industry-supported programs to provide Internet access in community centers in rural areas and in underserved urban areas will increasingly succeed and provide their intended societal benefits. The business model for Internet cafes provided by the private sector has been particularly successful in Peru. Demand for high speed Internet access is emerging. This demand can be met with Asymmetric Digital Subscriber Line (ADSL), cable modems and other technologies. ADSL is being deployed in Chile, Argentina, Brazil, and several other countries. An open question remains as to how important set top boxes will become for Internet access via televisions sets in Latin America. Two important trends -- wireless Internet access and carrier cost reductions including creating Internet Network Access Points (NAPs) -- will receive special focus below.

The "Wireless Internet" in Latin America

There is a tremendous potential in Latin America for wireless Internet access. This potential stems in part from the high penetration of mobile telephony in Latin America as shown in Figure 5. In Paraguay and Venezuela well over 50% of all telephone lines are mobile. In Bolivia, El Salvador, Chile, and Mexico over 40% of telephone lines are mobile. In Argentina, Brazil, Peru, Guatemala, Panama, Colombia, and Nicaragua over 30% of all telephone lines are mobile.



Source: ITU, May 2000

Plus 7 countries over 30% mobile:
Argentina (38%) Brazil (38%) Peru (37%) Guatemala (37%)
Panama (34%) Colombia (32%) Nicaragua (32%)

Figure 5

Figure 6 looks at scenarios showing the impact of varying the price of the Internet access device on Internet user growth in Chile. The bottom curve is the standard scenario with PC-based Internet access. With a PC price of about $US 1300 it shows about 600K users in April of 2000 growing to almost 1M users by April 2001 based on a fairly sophisticated Internet diffusion model developed at Telcordia. The top curve represents a scenario where wireless Internet access is assumed to be widely available and accessed via an Internet capable mobile phone priced at $US 150. When the diffusion model is applied to this hypothetical scenario, we would project over 2.5M Internet users in Chile by April 2001. Although the standard scenario (bottom curve) uses the model appropriately, the wireless device scenario (top curve) is simplified in that it only varies the price of the access device and also uses several other parameters (e.g., network externalities), but it does not use telecom, ISP, and wireless prices. If telecom and ISP prices were lowered over this period, Internet growth could even be greater (of course the supporting infrastructure would need to be available). The intent here is not to accurately project actual Internet growth with the less expensive wireless access device, but rather to demonstrate the potential impact that an inexpensive device can have on growth.

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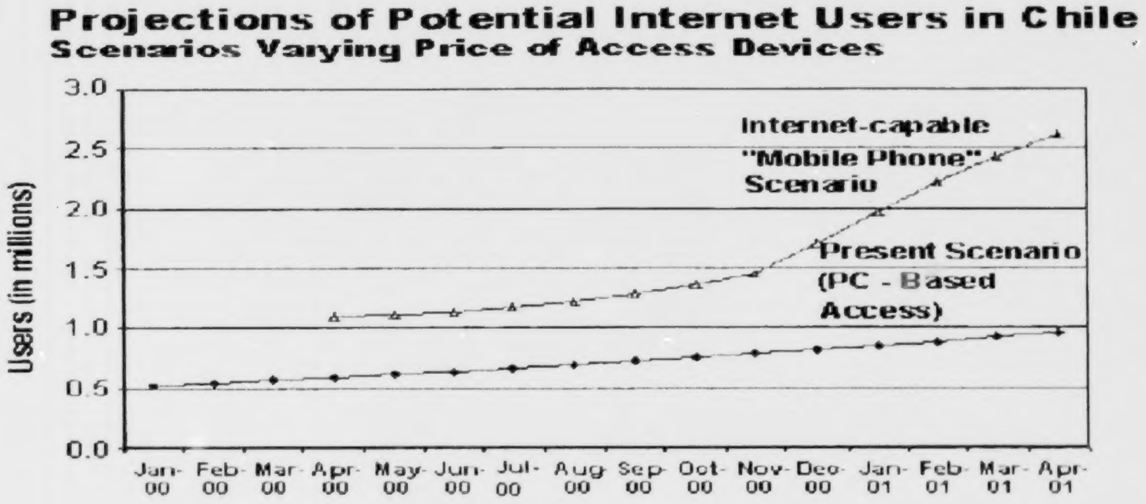

Figure 6

Source: Telcordia™ Internet Diffusion Models

Although PC-based Internet access will continue to grow at high rates, wireless access will likely be the Internet access technology of choice for the preponderance of Latin Americans, and it will cause a major new Internet growth surge. The growth is spurred in part by mobile telephone proliferation in Latin America as discussed previously. Access will be via internet-capable "mobile phones" or other hand held devices such a Personal Digital Assistants. The devices will be inexpensive relative to a PC -- about one tenth the price -- and as we have noted above, the price of the Internet access device has a significant impact on Internet growth. Wireless access may also be a very cost-effective technology for many areas in Latin America. PC-based and wireless Internet will co-exist although wireless will not displace existing wired access. Wireless Internet access will be the *first* Internet experience for many Latin Americans. Although today's sites and compacted versions of them will be accessible, they will not dominate in the wireless Internet market. New portals, web sites, content, and applications will be created specifically for small screens. The screen size and data rates will impact applications. The applications will not be as rich, however there will be good access for short messages, small amounts of information, etc. The business model for the wireless Internet is not yet clear -- it may not be advertiser funded and it may have cell phone-like charges which may impact affordability. Unless the goals are quite aggressive, wireless Internet access may meet most countries universal Internet access policy goals.

Carrier Cost Reductions Can Help Spur Internet Growth

There are several actions carriers can take to reduce ISP costs, increase profits, and lower prices to customers further stimulating Internet growth:

Plan, design, and implement local or regional Network Access points (NAPs). Two of the key functions served by local or regional NAPs are first as a place to aggregate traffic, possibly from multiple ISPs within a country or region, to send to a Tier-1 NAP in the US for global Internet connectivity. Costs can be saved by sending larger amounts of traffic over a larger transmission line from a single place compared to multiple smaller lines emanating from several ISPs. A second key function of the NAP is to eliminate the need to go to the US for intra-country or intra-region communications.

Explore the best (e.g., most cost-effective, content availability, availability of services) place to access the global Internet. For example, consider alternatives such as the NAP of the Americas (NAPA) in Miami. NAPA is a center of interconnectivity for Latin American countries; a focal point for Spanish content; may be less costly than reaching Tier-1 NAPs in Washington, DC, Chicago, or California; and offers a suite of value-added services.

Eventually create Tier-1 NAPs in Latin America. The concept here is to attract global backbone providers to come to and peer with each other at a small number of Tier-1 NAPs strategically located throughout Latin America. Although this would greatly reduce or eliminate the current cost of reaching the US, it may be several years before there is enough content in, users in, and traffic accessing Latin America to attract global providers. Achieving Tier-1 NAPs in Latin America may also require inter-country cooperation on policy initiatives as the Asia-Pacific Economic Cooperation (APEC) Telecommunications Working Group is pursing in Asia.

Each of the three NAP initiatives suggested above is of major importance for sustained and affordable Internet growth in Latin America.

Explore additional ways to reduce or optimize Internet traffic between Latin America and the US, Spain, Portugal, and elsewhere. Two of the many ways to reduce traffic include caching at local NAPs in Latin America and reaching agreements with the most popular sites in other countries accessed by Latin Americans to mirror those sites at one or more locations in Latin America. Other approaches involve optimizing capacity utilization of satellites, underseas cables, etc. and potentially developing off-peak usage strategies.

CLOSING REMARKS

As Latin American countries meet the above challenges, learn from and avoid mistakes of other countries, and seize the opportunities, the Internet will flourish and have major economic and social impacts in Latin America.

ACKNOWLEDGEMENTS

The author would like to acknowledge all of the Telcordia Internet Sizer research team especially Sam Weerahandi, Ricardo Martija, Alvaro Gonzalez, Elisa Santos, Victor Chien, Sunil Madhani, Joe Desmarais, and Dilip Patel.

Back to top of page **Back to the sessions page**

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Tom is the Executive Director for Internet and Global Information Infrastructure Initiatives at Telcordia Technologies (formerly Bellcore). His responsibilities include research and consulting for US and international clients to address economic, business, policy, regulatory, technology, and competitive issues related to evolving the Internet and making visions of an advanced Global Information Infrastructure (GII) become a reality. His responsibilities also include the economics of Next Generation Networks and measuring, monitoring and developing indicators for electronic commerce and its impact on the economy.

His department's recent consulting engagements include several Asian and Latin American governments and telecommunications firms. He has been instrumental in formulating public policy regarding the US NII, in framing critical NII interoperability scenarios, in articulating the potential impacts of the NII/GII on sustainable economic development, and in developing capabilities to measure Internet-based electronic commerce. He has been an invited speaker on these subjects at many national and international forums. His recent publications appear as chapters in key texts and in the proceedings of Latin American and Asian symposia. He served on the European Commission's "working circle of experts" on the impacts of the Information Society on Sustainable Development. He served as a member of the European Commission's Strategic Vision Panel of nine leading thinkers in economics, social change, and communications technologies to help define a vision for advanced communications in Europe in 2005-2010. Tom served on the US Federal Communications Commission's Telecommunications and Health Care Advisory Committee and chaired its Infrastructure Subcommittee. He also serves on the Board of Directors of the International Telecommunications Society.

Tom holds a BS degree in Mathematics from Holy Cross College and an MS in Computer Science from the University of Maryland. He also completed the European Marketing Program at INSEAD in Fontainebleau, France. He has previously worked for the US government, the University of Maryland, and Bell Laboratories.

Back to proceeding page   **Back to the sessions page**

AmPATH

Arthur S. Gloster

Abstract

PowerPoint Slides

http://www.fiu.edu

Florida International University

A member of the State University System of Florida, FIU is a doctoral-granting, public, multi-campus institution offering a diverse selection of undergraduate, graduate, and professional programs. Through its 15 colleges and schools, FIU offers more than 220 baccalaureate, masters, and doctoral programs, conducts basic and applied research, and provides public service to the community. FIU has been ranked among the top 100 public national universities in US News & World Report annual guide to "America's Best Colleges". In 1994, the Carnegie Foundation for the Advancement of teaching classifies FIU as a Doctoral I University, FIU has met the criteria of a Research II institution and has a planning goal to meet the criteria of a Research I institution by 2008.

FIU is a minority institution, with the largest contingent of Hispanic students of any degree-granting university in the country, and awards more Bachelors degrees to Hispanics than any other school in the nation. The University has the second largest contingent of African-American students in the state. FIU's diverse enrollment reflects the multicultural composition of our community, serving as one of the nation's largest doctoral-granting majority-minority universities. FIU play a key role in bridging the gap between the United States and Latin America through several research centers and national initiatives. Geographically, FIU's position at the southern tip of Florida in Miami has made it a natural conduit for South America, Central America, the Caribbean and Mexican entry into the United States.

FIUnet and High Performance Network Technology

FIU is a regional leader in networking technology. The University was awarded an NSF grant in 1999 to become an Internet2 connection point in South Florida. Since then, FIU has joined over 170 Internet2 members on the Abilene network. The University also offers Internet2 connectivity to Florida Atlantic University and the University of Miami through its GigaPOP connection.

The University has the experience, the staff, and the necessary technical and administrative resources to support a robust network. FIU's multi-campus network, FIUnet, provides LAN, WAN, Internet, and Internet2 services to approximately 10,000 networked computers on 120 LANs (1). Port speeds on LAN access devices range from 10Mbps shared Ethernet up to 155Mbps on ATM switches. The wide-area ATM service interconnects FIU's main (University Park) campus, the Biscayne Bay Campus, and the Wolfsonian Museum.

FIU / AmPATH Project: Low Cost / High Performance Service

The AmPATH project was undertaken by FIU in collaboration with Global Crossing. It exists to interconnect the

Research and Education networks in South America, Central America, the Caribbean, Mexico, and other international countries to Internet2, and US and non-US Research and Education networks through its Miami GigaPOP. FIU was able to establish its relationship with both Global Crossing and participating countries by recognizing the need for advanced Internet connectivity in the region and providing an achievable vision to establish the necessary infrastructure.

The AmPATH project uses Global Crossing's undersea optical-fiber network to build a high-performance ATM and IP network to connect the research and education networks in the Service Area to Internet2 and Next Generation Internet (NGI) networks in the US and other countries. The AmPATH project allows participating countries to contribute to the research and development of applications for the advancement of Internet technologies. The mission of the AmPATH project is *to serve as the pathway for Research and Education Networking in the Americas and to the world.*

The AmPATH project will provide each participating country a DS3 circuit, for three years, at no cost. The donated DS3s will connect the Research and Education Networks (RENs) of each country in the Service Area to Internet 2 connected networks via the AmPATH network (2). Abilene will be used to transit the IP traffic of the RENs, in the Service Area, to US and non-US NRNs. Connectivity to the Science, Technology and Research Transit Access Point (STARTAP) will also be available to provide connectivity to international networks that are not reachable through Abilene. This connectivity will also serve as an alternate (backup) to path to Abilene, and offer applications end-to-end ATM services, in the event it is requested. STARTAP is a global gateway infrastructure for research and education, fostering the interconnection of facilities, instrumentation, and networks. STARTAP's specific contribution has been to enable high-speed access to international information and is demand-driven by the needs of US scientists' international partnerships (3).

The AmPATH project began to take shape when FIU realized that South Florida, because of the number of undersea fiber cables landing on its east coast and because of its rich terrestrial infrastructure, was strategically positioned to become a major exchange point for high-volume Internet e-commerce with South America, Central America, Mexico, and the Caribbean. FIU proposed to Global Crossing a collaborative project, in which Global Crossing would allow FIU to use the available capacity of its optical-fiber network to build a high-performance network to interconnect the research and education networks in South America, Central America, Mexico, and the Caribbean to US and non-US NRNs. Global Crossing agreed to donate a DS3 of capacity to each country in their Service Area (4).

In turn, FIU took on a leadership role in this endeavor when it hosted the Advance Internet Connectivity in the Americas, http://www.net.fiu.edu/March_8th_2000_Meeting/ with a sponsorship by Global Crossing, and support from Internet2 and STARTAP, to present a proposal called AmericasPATH (AmPATH) to international representatives.

One of the main reasons why the Service Area has not achieved high-speed Internet connectivity to the US is the high cost of circuits. AmPATH sets out to solve this problem for the R&E community through a cost-sharing model and partnership contributions to keep participant costs as low as possible over an extended period. The following points summarize the many advantages of the AmPATH project.

1. Provides high-speed connectivity to US and non-US National Research Networks at a very, very low cost:

- DS3s to Miami are free (5) (most expensive and challenging part).
- Circuits to STARTAP and Abilene would be cost shared.

2. Offers connectivity to Internet2 and international Research and Education Networks for the Americas:

- By working together, everyone will benefit.
- Scales well as bandwidth requirements grow.
- Leverages more bandwidth for Research and Education traffic.
- Creates the critical mass to increase the degree of peering in the region.

Project Coordination

FIU will provide project coordination and develop advanced services as required. This effort will address a full range of issues, including interconnection planning, management of network interconnects, new service testing and integration, application optimization, performance measurement, traffic characterization, and documentation. Cisco Systems and Lucent Technologies will be donating equipment.

Heidi Alvarez will assist the PI in the evaluation of the service FIU is providing to insure the project requirements are being met. By becoming familiar with the applications and the researchers in the US and abroad that will utilize the proposed circuit, Alvarez will be in a key position. Alvarez will be able to field questions and coordinate network engineers in order to monitor network statistics, provide evaluation data regarding performance, bandwidth usage, or set up special equipment for these Internet2 applications in both test and production modes.

Eric Johnson and Maria Rosa Drake will be the technical point of contacts for the project. Johnson and Drake will aid in the international networks, STARTAP, and Internet2 in link establishment and serve as technical liaison to NSF. They will work with various network engineers to configure network control parameters, such as routing and virtual circuit/path setup. They will also provide the specifications to configure the routers and lead the technical management activities.

FIU Network Engineering & Telecommunications (NET) will continue the AmPATH web site at http://ampath.fiu.edu, adding and updating management and engineering information for the system. NET will publish graphs showing bandwidth utilization across the AmPATH network.

Project International Advisory Committee

To help ensure the ongoing progress and success of the project, FIU is proposing the formation of an advisory group to provide feedback and support. The AmPATH Technical Committee, to meet quarterly, will be comprised of representatives from Internet2, STARTAP, FIU, and Global Crossing.

Notes:

1. http://www.net.fiu.edu/diagrams.htm
2. The donated DS3 for Chile will be used to connect Chilean R&E networks. The observatories based in La Serena, Chile are considered US research institutions.
3. For example, Gemini partners Australia and the United Kingdom have established connections through STARTAP, which will ultimately enable full utilization of the high performance Internet applications associated with the Gemini Project.
4. The countries currently in the Service Area are: Argentina, Brazil, Chile, Colombia, Mexico, Panama, Peru, US Virgin Islands, and Venezuela.
5. The DS3s are only free for the countries in the Service Area.

Back to top of page   Back to the sessions page

Arthur S. Gloster II

http://www.fiu.edu

Dr. Arthur S. Gloster II is Chief Information Officer (CIO) and Vice Provost at Florida International University. As Chief Information Officer, Dr. Gloster reports directly to Dr. Modesto A. Maidique, President, for managing the overall planning, financing, and delivery of the campus computing, media, communications, and library services. As Vice Provost, he works closely with the academic community and participates in the Academic Planning Council. He also holds a professorship in Engineering Management.

Dr. Gloster is well known throughout the education and information technology fields with over 30 years experience serving on a number of Technology Industry advisory boards. In his previous position as Vice Provost for Information Technology at Virginia Commonwealth University and Medical College of Virginia, he was responsible for Libraries, Administrative Systems, Communication Services (voice, data, video), Computing Services (academic and medical), and the Multimedia Development Center.

As CIO at FIU, Dr. Gloster has articulated three initial primary goals; they are:

- To develop a ubiquitous broad bond network serving the FIU campuses and the community;
- Utilize new ways of delivering instruction asynchronously through the use of technology; and
- Support customer-focused administrative systems that will improve services to students and the campus community.

Dr. Gloster also served as Vice President for Information Systems at California Polytechnic State University and held earlier computing positions at Wayne State University, Southern Illinois University, University of Oregon, Appalachian State University, and Oak Ridge Associated Universities. He also held faculty appointments at several institutions. He received his BS and MS in Industrial Engineering from the University of Tennessee in 1961 and 1963; his Ed.S. in Educational Administration from the University of Tennessee, Knoxville in 1964; and, his Ed.D. in Educational Administration from Virginia Polytechnic Institute and State University in 1974.

With Dr. Gloster's appointment, the University established a new Information Resource Management (IRM) organization that brings together in a close working relationship several units handling information and communication technology. It combines the existing Academic Affairs units of Information Resource Management (IRM), Instructional Media Services (IMS) and the University Libraries into a single service organization. The goal is to foster an environment that facilitates the use of information technology together with library resources to support the learning, teaching, research, and public services missions of the of the University.

The new organization also includes the University Libraries. As institutions of higher learning approach the new millennium, university libraries are increasingly active in the collection and dissemination of information by electronic means.

Dr. Gloster has authored over 100 technical papers and made over 200 presentations to audiences in higher education and technical organizations.

Back to proceeding page **Back to the sessions page**

Internet Market Opportunities In Latin America

Fabio Ferreira Kujawski and **Oscar Petersen**

Abstract

www.carvalhodefreitaseferreira.com.br

I - THE INTERNET SCENARIO IN LATIN AMERICA REGION

Latin America has been demonstrating a tremendous growth of Internet users and services as of the implementation of free Internet access coupled with bank, content providers and telecommunications service provider associations.

Moreover, operators have already been offering broadband services, including data transmission services through WAP (Wireless Application Protocol) technology.

By February, 2000, Latin America reached 7 million users and the growth rate of electronic commerce was 117% per year. In Brazil, the number of users jumped from 1.4 million in January, 1998, to 4.5 million in July, 1999. In the beginning of 2000, there were more than 6 million users.

The following table indicates the estimated evolution of e-commerce in Latin America over the next few years:

Electronic commerce in Latin America between 1999 and 2003 - in US$ millions [1]

Year	**Sales to the ultimate consumer**	**Sales between companies**	**Sales between companies and other consumers**
1999	116.2	252	90.5
2000	226.3	645.4	187.1
2001	437.8	1,517.3	399.1
2002	930.2	2,973.5	745.6
2003	1,671.1	5,097.2	1,253

The table below provides an overview of the participation of certain countries in the Latin America scenario, in respect to online commerce users and billings:

COUNTRY	USERS (%)	BILLINGS (%)
BRAZIL	45	88
MEXICO	18	6
ARGENTINA	9	2
CHILE	4	1
OTHERS	24	3

Thus, there is also an enormous potential for B2B and companies are already aware of the savings that business on Internet can generate. The association of B2B earnings with Brazil's potential in electronic commerce, which is expected to surpass US$ 220 million this year (2000), reveals that nobody can afford to remain an outsider of the virtual world.

Latin America is a potential market for e-commerce, but needs to overcome certain barriers for the benefits of Internet to be consolidated in the region. Nevertheless, B2B is growing at an alarming rate and should move US$ 1.5 trillion worldwide in 2005, a figure almost ten times greater than B2C, which comes chiefly from the industrial markets. The chemical sector alone will be responsible for a 1.5% to 2% share of this sum.

Specialists, however, view certain factors that may prevent Internet resources with commercial purposes in Latin American from being exploited, with concern. The deficient distribution of income, the high cost of Internet access media and the lack of financing resources like Venture Capital are just some examples. Deficient logistics is another problem that may prevent the region from reaping the benefits of e-commerce. But the countries of Latin America must face this challenge, given the fact that Internet is a reality and a factor of change that will lead to the creation of new business parameters. Even more so, because Latin America, with a forecasted GDP of US$ 1.2 trillion for 2003 - is the market presenting the highest growth in Internet access.

In addition, in accordance with a study conducted by Giga Information Group in the US, the companies that are using Internet technologies to improve their businesses, and trading through business-to-business electronic commerce, will globally economize more than 600 billion dollars a year, as of 2002.

The worldwide growth presented by electronic commerce in recent years and the great potential of this market are evident. However, the principal barrier for the growth of electronic commerce, at the international level, is the lack of specific legislation regulating the sector, or, further, the existence of obsolete rules that are incompatible with this type of commerce, mainly in what refers to the security of the transactions. This concern has led various countries to seek solutions for the adaptation of their legal systems, in order to solve the various issues imposed by the rapid growth of electronic commerce, notably the problem of the validity and probative force of online transactions and electronic signatures.

II- THE NEW TELECOMMUNICATION MODEL

TELECOMMUNICATION SERVICES x VALUE-ADDED SERVICES

From this point on, we are going to address the Brazilian market, within internet and ecommerce issues, given the singular significance of this country within the Latin America region.

We will be referring to legal aspects related to the provision of internet services in Latin America, notably in Brazil, as well as the most relevant contemporary issues regarding telecommunications and value-added services (VAS) within the region.

To this end, this analysis will describe the scope of value-added service, its characterization and the manner in which it can be rendered, in order to fully outline the regulatory scenario involving the provision of internet-related services.

Communications Ministry, under the command of the then Minister Sérgio Motta, commenced the restructuring of the entire telecommunications model prevailing in Brazil, having as its historical milestone the publication of the General Telecommunications Law (GTL) on July 16, 1997.

With the publication of the GTL, the telecommunications sector was substantially changed, presenting new concepts and necessary definitions for the development of a modern and audacious model aimed at satisfying the needs of Brazil's society by means of competition among private agents.

In this context, the GTL brought a concept, which was objective and disassociated from technological paradigms to define the meaning of Telecommunications and Telecommunications Service, as can be verified below:

> *"Art. 60. Telecommunications service is the group of activities that enable the supply of telecommunications.*

> *§ 1 Telecommunications is the transmission, emission or receipt, of symbols, characters, signals, writings, images, sounds or information of any nature by wire, radio electricity, optical media or any other electromagnetic process.*
>
> *§ 2 Telecommunications station is the set of gear or apparatus, devices and other necessary media for performing telecommunications, their accessories and peripherals, and, when applicable, the facilities that accommodate and complement same, including portable terminals.*

Under these terms, it can be said that any activity that permits the supply of the transmission, emission or receipt of symbols, characters, signals, writings, images, sounds or information of any nature by wire, radio electricity, optical media or any other electromagnetic process will be considered Telecommunication Service.

Along with the definition of Telecommunication Services, article 61 of the GTL brought a new definition for Value-added Service, revoking previous definitions set forth in applicable law.

> *"Art. 61. Value-added service is the activity that adds to a telecommunication service which lends support thereto and is distinct therefrom, new utilities related to the access, storage, presentation, movement or retrieval of information.*
>
> *§ 1 Value-added service does not constitute telecommunication service, and its provider is classified as a user of telecommunications service that lends it support, with the rights and obligations inherent to this condition.*
>
> *§ 2 Interested parties are assured the use of telecommunication service networks for the provision of value-added services, it being incumbent upon the Agency to assure this right, regulate the conditions, and the relationship between such interested parties and the providers of telecommunications service."*

Given the definition brought by the GTL, it is important to draw your attention to certain characteristics of Value-added service, namely:

- **Value-added Service is not a Telecommunications Service;**
- **Value-added Service is distinct from Telecommunications Service;** and
- **The provider of Value-added Service is equivalent to the user of Telecommunications Service**.

III - Internet - value-added service

In the preceding lines, the concepts that distinguish and define Telecommunications Services and Value-added Services were presented. It thus remains to apply these concepts to Internet.

Among the Telecommunications Services that support the provision of Internet Connection Service, Fixed Switched Telephone Service (FSTS) is without any doubt the most widely used worldwide. It can be noted, however, that the development of new technologies has been permitting the use of other Telecommunications Services, other than FSTS, for supporting the provision of Internet Connection Service, which have been permitting the so-called "Broadband" access or "High Speed Internet" with speeds superior to those permitted by FSTS, as can be verified below [2].

COMPARISON BETWEEN DIFFERENT TELECOMMUNICATIONS SERVICES FOR ACCESS CONNECTION TO INTERNET

Technology	Upstream Speed	Downstream Speed	Operators in Brazil	Positive Issues	Negative Issues

ADSL	Up to 1 Mbps	Up to 8 Mbps	CTBC Telecom, Telefônica	Permanent connection, line release	Cost of modem
Cable modem	56 kbps to 129 kbps	256 kbps to 2 Mbps	TVA (Ajato), NetSul (Cable Modem Net), TV Filme (LinkExpress), Globo Cabo (Virtua)	Permanent connection, line release (in bi-directional)	Cost of modem
MMDS	Up to 128 kbps (reversal by telephone)	Up to 2 Mbps	TVA (Ajato) and TV Filme (LinkExpress)	Coverage of service (with an antenna) in a small or medium-sized city	For the time being is only unidirectional
Satellite (DirecPC)	Up to 128 kbps (reversal by telephone)	Up to 400 kbps	Not yet available in Brazil. Rendered by Hughes in the USA	Flexibility of installation, coverage area	Cost of service
LMCS (LMDS)	Up to 10 Mbps	Up to 155 Mbps	Still being regulated by Anatel	Indicated for regions with high subscriber density, high data capacity	Has a lesser reach than MMDS and is sensitive to interference

As can be observed from the table above, the quality of Internet access is directly associated to the quality and capacity of the Telecommunications Service lending support thereto.

The Regulatory Agency - ANATEL (National Telecommunications Agency) has been striving to regulate the use of other Telecommunications Services for permitting the provision of Internet Connection Service especially by means of broadband access, as analyzed herein below.

IV - Broadband and Internet Access

IV.1 - Internet Access Via the Adsl System

Digital Subscriber Line or simply DSL is a technology that permits the use of telephone lines as high-speed channels for data, video, information, entertainment and other applications.

DSL Technology does not refer to a new transmission line concept, but rather to a system of modems that converts standard signals of the FSTS network into a high-speed digital duct for data traffic.

The telecommunications market has been developing a series of technical standards that permit directing DSL to the mass market, in order to guarantee data transmission with speeds of up to 2Mbps, with the possibility of achieving even greater speeds with the joint use of various symmetrical modems.

Among DSL's characteristics we may feature:

- supply of high speed remote access to Internet, corporate networks and online services supported by common telephone lines;
- parallel and simultaneous use of voice and data transmission in some types of DSL;

- continuous activation and connection of the DSL system;
- use of interactive multimedia in real time and high quality video transmission (TV via Internet, videoconference, etc.);
- possible use of copper wires for supplying high speed for remote access to Internet, corporate networks and online services; and
- creation of adequate networks for IP and ATM traffic

As can be perceived from the foregoing considerations, ADSL (Asymmetric Digital Subscriber Line) permits numerous applications for data transmission. Thus, FSTS operators have been investing in the development of this technology, with the objective of supplying FSTS users with rapid access to Internet, with the simultaneous use of a telephone line for originating and terminating calls, while at the same time constantly maintaining the connection with the Internet access provider.

IV.2 - Unbundling and Internet Access by Pay TV Services

ANATEL's objective with the publication of the Regulation for the Use of Pay Mass Communication Service Networks for the Provision of Value-added Services approved by Resolution n.° 190, of November 29, 1999, was to ensure the use of Cable TV Service Provider, Multipoint Multichannel Signal Distribution (MMDS) and Direct to Home (DTH) networks, hereinafter called Pay TV Services, by VAS.

This regulation guarantees Value-added Service providers the right to use Pay TV networks, in a non-discriminatory manner and at fair, reasonable and isonomic prices and conditions. However, the Pay TV Service provider may only make access to Value-added Services available to its subscriber terminals through its network.

The use of Pay TV networks for the provision of Value-added Service may only be denied owing to reasons of the system's limited capacity or conditions determined in telcos' concession contract or authorization term. The denial of the use of Pay TV networks shall be justified in a non-discriminatory manner.

One of the main provisions of the respective regulation is the prohibition of the provision of Internet access service by Pay TV Service providers. In order to provide such service, Pay TV providers are required to set up companies exclusively for this purpose.

IV.3 - The Bidirectionality of MMDS and Internet Access

MMDS is a telecommunications service, characterized as a Special Service category, and is technically known in Brazil as Multipoint Multichannel Distribution Service.

MMDS is a collective interest service, rendered under the private regime, which uses the microwave band to transfer signals to be received in given points within the service provision area, pursuant to the regulations.

In accordance with article 4 of the Telecommunication Services Regulation and article 8 of the Regulation for the Use of Pay Mass Communication Service Networks for the Provision of Value-added Services, MMDS service is considered a mass communication service, simultaneously presenting the following characteristics:

- distribution or broadcast of point-to-multipoint or **pole-to-pole** signals;
- signal flow predominantly downstream;
- transmission content is not generated or controlled by the user;

- choice of transmission content is made by the service provider.

The MMDS Service is designed for promoting the diversity of information sources, stimulating intra and inter-service competition, preserving the interests of local communities and making good use of the frequency spectrum.

Under these terms, Rule 002/94, with the new wording approved by Ministry of Communications Ordinance 254/97, established that the company authorized to provide MMDS may, among other aspects:

a. transmit signals or programs originated by third parties, programs originated by third parties and edited by the authorized company, and transmit signals of programs generated by the authorized company; and

b. broadcast commercial publicity.

With the objective of designating the 2,170 MHz to 2,182 MHz frequency band to be used by MMDS users as an upstream channel, that is, as a means of sending information from the user equipment to the data communication equipment located in the central MMDS service station, ANATEL issued Resolution n.° 224, of May 22, 2000.

V -Voice OVER IP

The so-called Voice over IP is characterized by the transmission of voice signals using the IP protocol applied to public or private data networks and is considered by the telecommunications market as one of the main centers of growth over the next few years.

Many market specialists forecast that Voice over IP will be capable of rapidly changing, both the telecommunications industry and data communication, since, even though supplying quality inferior to that of FSTS, the consumption of such services has been growing in a constant manner worldwide.

The technological development that permeates the development of Internet itself has been permitting the increasing development of software allowing for voice communication via Internet.

In this context, a number of companies are beginning to supply Voice over IP services in the Brazilian market, generating great controversy in the market in relation to the lawfulness of the supply of such services.

The great challenge lies in the precise identification of Voice over IP service as a Telecommunications Service or Value-added Service, in accordance with the definition established by the GTL and described at the beginning of this study.

The definition of Voice over IP as a Telecommunications Service or Value-added Service will generate a series of legal consequences, including implications as from the tax authorities perspectives.

Note that the definition of telecommunications service established by the GTL, mentioned above, is not associated to any technology or any service provision media, but rather to the transmission, emission or receipt concept.

On the other hand, if we consider that Voice over IP is a service provided on a protocol applied to Internet, which in turn is accessed via an Internet Access Provider (Value-added Service), this would mean to say that Voice over IP is a service supplied by access to Internet and, thus, a Value-added Service.

Thus, we can see different ways of using Voice over IP. The three main uses are described below:

- Provision of Voice over IP permitting voice communication between personal computers connected to Internet (requisites include the use of a modem, compatible logical support, loudspeakers and microphones to permit communication);

- Provision of Voice over IP permitting voice communication between one personal computer connected to Internet and a FSTS subscriber using its telephone line; and

- Provision of Voice over IP permitting voice communication via Internet between two FSTS subscribers using its telephone line.

In order to defend that VoIP is a VAS, and, as such its provisioning is not conditioned to the grant of a license by ANATEL, the companies providing same use a wide range of arguments, among which we single out the most frequently used ones.

- Voice is not a service, it is merely one of the advantages of the corporate service package;

- This IP technology may be used even by a common telephone set. However it is not of a public nature, since the services are provided by means of virtual networks of corporate use, and exclusively for the use of the customers, who have their own identification number and password for accessing these services;

-

- It happens that the concept of Value-added service, as a legal and unquestionable principle, does not constitute telecommunications service, and may be rendered without the need of a prior grant;

- There is no specific legislation in Brazil on Voice over IP services;

- Internet and its protocols are governed worldwide by the principle of non-state regulation and the GTL excluded Internet services from the scope of state regulation.

As can be observed from the foregoing analysis, that there are arguments supporting the position of Voice over IP service providers and otherwise.

Voice over IP is a subject being widely discussed on a worldwide scale. Depending on the legislative and regulatory characteristics of each country, the subject is surrounded with important differences that often merit study for analogical application to Brazilian law.

Note that Voice over IP is not only a concern in the Brazilian regulatory scenario; it is also a worldwide concern. It came to our knowledge that, within the European Economic Community ("EEC"), Voice over IP communication to be considered a telephone service, shall have the following characteristics:

- Voice over IP shall be subject of commercial exploitation;

- Voice over IP shall be supplied to the public;

- Voice over IP shall connect two points simultaneously connected to the public network;

- Voice over IP shall include voice transmission and switching in real time.

It is relevant to mention that FSTS concessionaires, as well as their controlling, controlled or associated company cannot apply for a new telecommunications license until Dec. 31, 2003, or until Dec. 31, 2001, in the latter case, if all concessionaires meet all their expansion and universalization obligations by that date. Consequently, there are several implications to these companies in the internet environment (not only regarding VoIP), which must be very carefully analyzed.

Finally, it may be said that Voice over IP is in fact one of the principal challenges for the telecommunications sector, which has been contributing greatly to the technological advancement of solutions that increasingly permit the continuous and development of communication and, consequently, of the legal developments that permeate this new scenario.

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1. Source: *Gazeta Mercantil of 5.29.2000 to 6.4.2000.*

2. Data obtained from *Special Internet in High Speed - Teletime - Pay-TV Magazine*

Back to top of page **Back to the sessions page**

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Fabio Kujawski - Born in the Capital City of the State of São Paulo, Brazil. Graduated from the Catholic University of São Paulo Law School, with emphasis on International Public and Economic Law and International Commerce. Worked at the São Paulo and Miami Offices of Baker & McKenzie Attorneys-at-Law (from 1994 to 1996). Currently, Mr. Kujawski works as a Counsel at "Carvalho de Freitas e Ferreira Attorneys at Law", in the field of Telecommunications, Public and Corporate Law. In 1998 and 1999, Mr. Kujawski was retained as Off-counsel for the Brazilian Telecommunications Regulatory Agency (ANATEL), for drafting the "Fixed Switched Telephone Services Regulation" and "Telecommunications Equipment Certification Regulation". Attended several International Symposiums and Congresses, including as Speaker and Moderator. The most recent speeches done by Mr. Kujawski were: In 1999: 13th International Congress of the Brazilian Computer and Telecommunications Law Association - ABDI, regarding "Mediation and Arbitration Procedures in the Brazilian Telecommunications Regulatory Agency (ANATEL)"; In January 2000: 22nd. Annual Conference of the Pacific Telecommunications Council, in Hawaii. In May 2000: Tel.Ecommerce Congress in Geneva, Switzerland, regarding ecommerce in Latin America. In June: IntelecardExpo Conference, in Miami Beach, regarding prepaid telecommunications services and cards in Latin America. In June 2000: Upon invitation by the Brazilian-American Chamber of Commerce, speech for international investors in New York City, at the Harvard Club. In October 2000: IBC Prepaid Wireless Forum, in San Diego, regarding prepaid services and wireless internet in Latin America. Mr. Kujawski was co-responsible for preparing and negotiating the pioneer Network Interconnection Agreements involving Fixed and Mobile Telecommunications Services Providers, as of the privatization of the former State-owned Telecommunications Companies. Within the telecommunications regulatory environment, Mr. Kujawski's areas of expertise are Fixed and Mobile Telephony, Satellite, Internet and ecommerce, Value Added Services, Cable TV, Cabling and Infrastructure, Billing and Collection Affairs, Certification of Equipment, among others. Within other legal areas, Mr. Kujawski has expertise in civil, commercial and "computer-law" contracts, as well as Corporate Law. Author of several legal-related articles published worldwide, in the field of Telecommunications and Public Law.

Back to proceeding page **Back to the sessions page**

Will the US Infrastructure Build Pattern Repeat Itself in Emerging Nations?

Pravin Jain

Abstract

PowerPoint Slides

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There is a tendency, especially among the US companies to believe that patterns that take place domestically will repeat themselves in other parts of the world. They think that it may take a bit longer in some parts of the world, but the fundamental development patterns shouldn't be all that different from what has taken place in the US.

After getting off the ground a successful start up called FirstPoint Communications (later renamed Enron Communications) in USA, I went off to Brazil to set up a similar business venture there. The formula for my US start up was very straightforward: find a high value route to lay fiber optics on, pre sell sufficient fiber to cover most of the capital outlay, end up with a near zero cost position on a valuable piece of infrastructure, use that piece as trading currency for swaps, sales and a fantastic market cap to fund the build out of a greenfield communications company. Of course, the key factor that made pre-sells etc. possible was the great number of new players jumping into the market.

This premise is pretty much what has driven the fiber infrastructure build out in USA by companies such as QWEST , Williams Communications and Touch America. These were companies that I collaborated with while starting up Firstpoint Communications. The premise of using the high valuation that the market was willing to give to ownership of infrastructure and greenfield advantages for developing the funding mechanism was what each of us counted on with our respective boards. And it worked! The next step seemed so obvious: take this clever little formula developed in USA and export it to other parts of the world.

As we went about setting up a base in Brazil with the intentions of creating a Southern Cone Communications company, we began feeling some resistance to executing the infrastructure model that had worked so well for us in the US. For one thing, we noticed a real lack of new players jumping in. There were many with announced intentions of becoming players, but very few that were actually willing to put any skin in the game. The ones that did put significant capital were buying into incumbents with existing infrastructure. Unlike in USA, there weren't too many greenfield operations actually putting up the capital. Initially, our tendency was to attribute this resistance to the stereotypical issues of developing nations. It just takes longer to close things in this part of the world, it's just the local culture thing, one needs the right connections to get things done around here, etc. etc.

Months went by and we came across other US companies with similar goals and objectives, going through struggles and attributing them to similar emerging nations' kinds of issues.

What follows in this paper are the insights that my team gained when we finally decided to put our stereotypical notions aside and look at the situation with a fresh set of eyes. We realized that there exists a fundamental difference among the forces that shaped the patterns in the US and the forces that are at work in these regions. Without an understanding of these forces and the wavs in which they are different, the US companies are exposed to not only making some very expensive errors but also add to the image of that US centric arrogance that US corporations are becoming (in)famous for.

The US Fiber Infrastructure Build Out

The graph on exhibit 1 depicts the pattern that the US build out has exhibited so far. The key driver in this pattern has been the number of new players emerged in each phase.

Let's take on AT&T Phase:

This is the phase when AT&T was being disassembled and their network was designed and managed on the philosophy of ' dialtone, anywhere, at any time, at any cost'. This philosophy, by the way, is what gave USA one of the finest communications systems in the world. As fashionable as it has become lately to believe that competition and free market lead to higher levels of innovation, AT&T, in its' monopoly era, had exhibited the most impressive track record of innovation with Bell Labs shattering all records on number of patents being granted.

This is when MCI and Sprint came on the scene and capitalized on the prevalent belief that competition will bring down the cost of telephony to the end user. These challengers, of course had free access to the technologies that AT&T had heavily invested in developing. The promise of competition bringing costs down gave MCI and Sprint the market valuations to fund their evolution into full fledged communications companies. The pendulum seems to be swinging back now in the direction of ' economies of scale' being more important for reducing the costs to the end user' as evidenced by the proposed merger of MCI and Sprint.

The key point to note here is that the valuation that the market was willing to give to the pro competition premises is what funded the infrastructure that MCI & Sprint were able to build. The extent to which the market of a particular region values these premises is going to be critical to determining the level of infrastructure that gets funded. The AT&T equivalent of Brazil, Embratel, is actually enjoying a very different public image than what AT&T had in this era. AT&T was looked upon as the big bad monopoly, whereas several surveys in Brazil have shown a very high level of satisfaction with Embratel in the Brazilian markets and Intelig, the challenger, is believed to be having a difficult time obtaining support for infrastructure investments.

Post MCI/Sprint Slowdown Phase:

In the era following the emergence of MCI/Sprint there was actually a significant slowdown in the amount of fiber deployed. The general belief in the market was that there was sufficient infrastructure to support competition in telephony.

The Second Wave of Infrastructure Build Phase:

The US defense department funded the core infrastructure of something called Internet and handed it over to the private sector. This core infrastructure consisted of high capacity backbone, but more importantly, it had something called 'peering arrangements', which simply took care of all interconnection issues and gave ubiquity to this new infrastructure.

The market saw a glimpse of what this IP infrastructure could do and a new window opened up of high valuations for companies that would build 'data optimized' next generation IP network. This is the window that has led to funding of millions of miles of fiber and equipment infrastructure in USA over the last decade by players such as Williams, Touch America, QWEST, Enron, MFS, Level Three, GST, etc..

These same players are looking at regions such as Brazil and India and the huge gaps in fiber kilometers deployed. Their logic is that if anything close to how things played out in USA were to happen in these regions, there should be tremendous opportunities for infrastructure plays in these regions. So they jump in and after several years of development and millions of dollars, find themselves frustrated with the regions.

The fact is that the fundamental forces that have driven the infrastructure building in USA do not, and maybe need not, exist in some of these regions.

The reasons that normally get attributed to the development patterns of these regions; such as local politics, corruption, culture are; in my opinion, a result of confusing symptoms for causes.

Let's now take a look at some of these forces and examine their play in other regions. I am going to use Brazil to represent ' other regions' , mostly because it is the region I am most familiar with and I believe it to be quite representative of most emerging nations.

- **Down with the big bad monopoly!**

  Unlike AT&T, Embratel has been quite aware of the need to respond to the changing times and has done an excellent job of proactively adding onto the service offerings, price cutting and embracing the new technologies. This is evidenced by the high satisfaction ratings received by Embratel in recent market surveys.

  Given this, the market valuation and support enjoyed by MCI & Sprint is not available for the challengers in Brazil. The main challenger, Intelig, is finding it difficult to fund infrastructure deployment that would be required to effectively compete with Embratel.

- **Technology Advantage of Greenfield Network Player**

  This is one of the key claims the new players were able to use for receiving high market valuations which they could then translate into a funding mechanism for their infrastructure build outs.

  The US market in the recent years has begun to see the limitations of many of these new technologies. DWDM has put at risk many of the SDH/Sonet based deployments, ATM is being questioned for scalability, Pure IP is running into difficult issues regarding traffic engineering and metering, DSL penetration is showing some practical ceilings, the Low Orbiting Satellite plays of companies like Teledesic have yet to demonstrate viability and even cable modem is struggling to make the numbers work in all but a few select markets. The market has pulled back, ruthlessly in some cases, the valuation from these companies, leaving them incapable of executing their complete game plans.

  The high rate of development in technology has also made obsolescence a very real phenomenon.

  Combined effect of all this, especially in high cost of capital regions like Brazil, has been one of transforming greenfield advantage into greenfield risk; making funding for these ventures extremely difficult..

- **Elusive Ubiquity**

In path based world of telephony, interconnection with other network owners is feasible to achieve a certain level of ubiquity. In the non-path based world of IP, this has turned out to be a real challenge. The issue goes beyond costs & politics; it is one of how the IP world fundamentally handles packets of information.

Many of the greenfield players in USA have done a great job of rushing through execution of their networks, only to come to a screeching halt at the last bit of interconnection needed for successful commercial deployment of their networks. This has meant missed earning promises, pull back on market cap and in some cases, bankruptcy.

Regions such as Brazil, where interconnection mechanisms such as the early NAP's of USA don't exist, this whole phenomenon of ubiquity has become a major deterrent to new players jumping in.

- **International Reach**

Most of the content the data world needs to access, at least for now and the forseeable future, resides on servers based in USA. For a new player to have a viable business model, international network access is a must.

The submarine cable world has been dominated by consortiums consisting of a handful of established players. The private cables launched in the last couple of years are open to new players, but these cables have yet to prove their commercial viability. With the exception of a few regions where the deregulation process is pretty far along, these private cables have run into significant resistance from the dominant players in that region that feel their investments in consortium cables are threatened by the success of these private cables.

Lack of international reach is going to continue to be a significant factor in the ability of a new player in regions like Brazil to get funded and therefore be able to add to the infrastructure.

- **Capacity vs. Demand dilemma**

Most of us building networks in USA, including those of us at FirstPoint, were able to get around the capacity vs. demand and the resulting pricing scenarios, by showing our investors fiber presells and pointing to the incredible valuations paid by companies such as LDDS to Wiltel for the network.

With market valuations reverting back to earnings, the focus is shifting back to the classic demand/capacity/pricing models. This is especially true of investors in regions like Brazil where they have seen the rug being pulled out from under their role model companies in the US over the last few months.

Anyone who has made an honest attempt at the capacity/demand/price models will realize the impossibility of defending their positions against what I call 'the wide swing variables'. Here are some examples of that:

- Impact of advances in optics on the incremental cost of producing an additional mb/sec., especially if some of these advances solve compatibility issues for the older installations.
- The incremental cost of producing a mb./sec. from the extra dark fibers and extra ducts that have been placed by many of the recent players.
- Chances of an infrastructure owner, who has sold enough capacity on his network to essentially have zero cost position on his remaining network, suddenly dumping capacity at fire sale prices
- Security and privacy issues forcing data networks to go back to path oriented technologies
- Delays in having an interconnection structure, financial & technical, available in the IP world could cause more players to go defunct causing additional capacity dumps in the market

The uncertainty caused by these variables around the pricing assumptions make most investors from backing off of the new infrastructure plays. There are several infrastructure plays in Brazil that have been in the mode of being shopped to investors for over two years now. The segment that can benefit from this uncertainty, and the one that is gaining favorable attention from the investors in USA is bandwidth trading. Uncertainty around pricing creates different entities in the market with different beliefs about the outcomes; this in turn forms the basis of bid-offer spreads, which is what's needed for traders to prosper.

For regions such as Brazil, trading becomes a problem of catch 22. Price uncertainty without liquidity does not lead to trading, but further restrains plays that could help create liquidity.

In summary, because of these shifts in some of the fundamental forces, we should expect to see completely different patterns of infrastructure development unfold in these regions. For some countries, it may make sense to have the incumbents take on the role of being the infrastructure providers with some level of regulation and government aid, and then have competition take place at the application level. Anyway, the important message of this paper is to convey the unliklyhood of the US pattern playing out in other regions and therefore remaining open to all other possibilities.

Back to top of page **Back to the sessions page**

Pravin J. Jain

Vice President, Global Risk Management Group
Enron Broadband Services

Pravin Jain is Vice President of the Global Risk Management Group at Enron Broadband Services (EBS). His role at EBS is focused on developing the company's bandwidth trading business worldwide. His group has already succeeded in setting up a South American business as an extension EBS' operations in the United States.

Pravin was one of the founders of FirstPoint Communications in 1996, which was later renamed Enron Broadband Services. He was responsible for launching and completing a 2000-mile, $150 million fiber-optic build in partnership with Montana Power and Williams Communication. This project was later expanded into a nationwide IP network through swaps and sales. Prior to EBS, Pravin was Principal and CEO at McClure Industries, where he produced a dramatic turnaround in margins and record revenue growth in 1996 and 1997. Earlier he was an Operations Manager for James River Corporation for four years and ran his own corporate consulting firm prior to that.

Pravin holds a bachelor's degree in Mechanical Engineering, a master's degree in Industrial Engineering, and an MBA.

Back to proceeding page **Back to the sessions page**

Technology

Monday, 15 January 2001
1100–1230

M.1.4 New Satellite Initiatives I

(Webcast, sponsored by Compaq)

Location: Tapa II

Chair: EDWARD SLACK, Lockheed Martin and Comsat, *USA*

M.1.4.1 Broadband Infocom in the Early 21st Century–What's Coming? (ABSTRACT)

MIKE WILLIAMS, President & GM, Systems & Technology, Lockheed Martin Global Telecommunications, *USA*

M.1.4.2 Trends and Prospects for Commercial Launch Services (ABSTRACT)

BRUCE S. MIDDLETON, Principal, Asia Pacific Aerospace Consultants Pty Ltd (APAC), *Australia*

M.1.4.3 The Multimedia Migration: Transponder Versus Processing Payload VSAT Networks (ABSTRACT)

ERIC WISWELL; DANIEL AZAREN; WILLIAM COURTNEY; JOSEPH FREITAG; PETER HADINGER; DOUGLAS SHANNON; and TERENCE SMIGLA, TRW Space & Electronics Group, *USA*

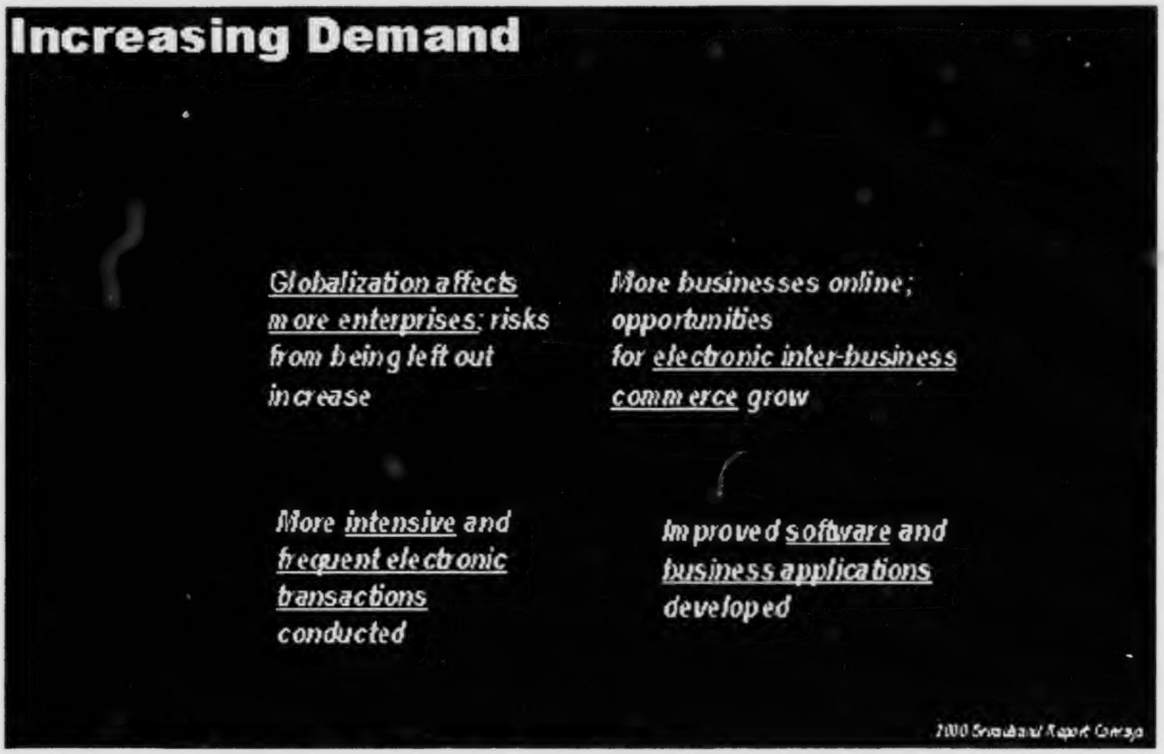
Broadband Infocom in the Early 21st Century - What's Coming? January 15, 2001

Mike Williams

Abstract

www.lmgt.com

The Global Market: 2000 - 2010



Increasing Demand

Globalization affects more enterprises; risks from being left out increase

More businesses online; opportunities for electronic inter-business commerce grow

More intensive and frequent electronic transactions conducted

Improved software and business applications developed

2000 Broadband Report [illegible]

I doubt I will get any disagreement from this audience that the fundamental nature of information communication is changing dramatically with changes across many global fronts, not the least of which is technology. The breakout of relative global peace has allowed us to focus both capital and technology on information and telecommunication technology for commercial markets. It's also encouraged the lessening of global tensions and the corresponding increase in interdependent economic relationships and reduction in trade barriers. The nineties saw that process begin. The United States and other world economic powers led this technical and commercial charge during the nineties and reaped most of the economic benefits. But a number of very fundamental changes were begun globally and many stubborn cultural, regulatory, and economic phenomena are inevitably being changed. In this upcoming decade, we will see the results of these changes. I believe they will take place much faster than we are anticipating and they will fundamentally change key presumptions about our business. I have a feeling that many of us in this room are still seeing things the way we want to see them, and have gotten used to seeing them, rather than seeing them as they are likely to be.

The great technology driver for the radical changes in our industry has clearly been the internet. But the internet is still

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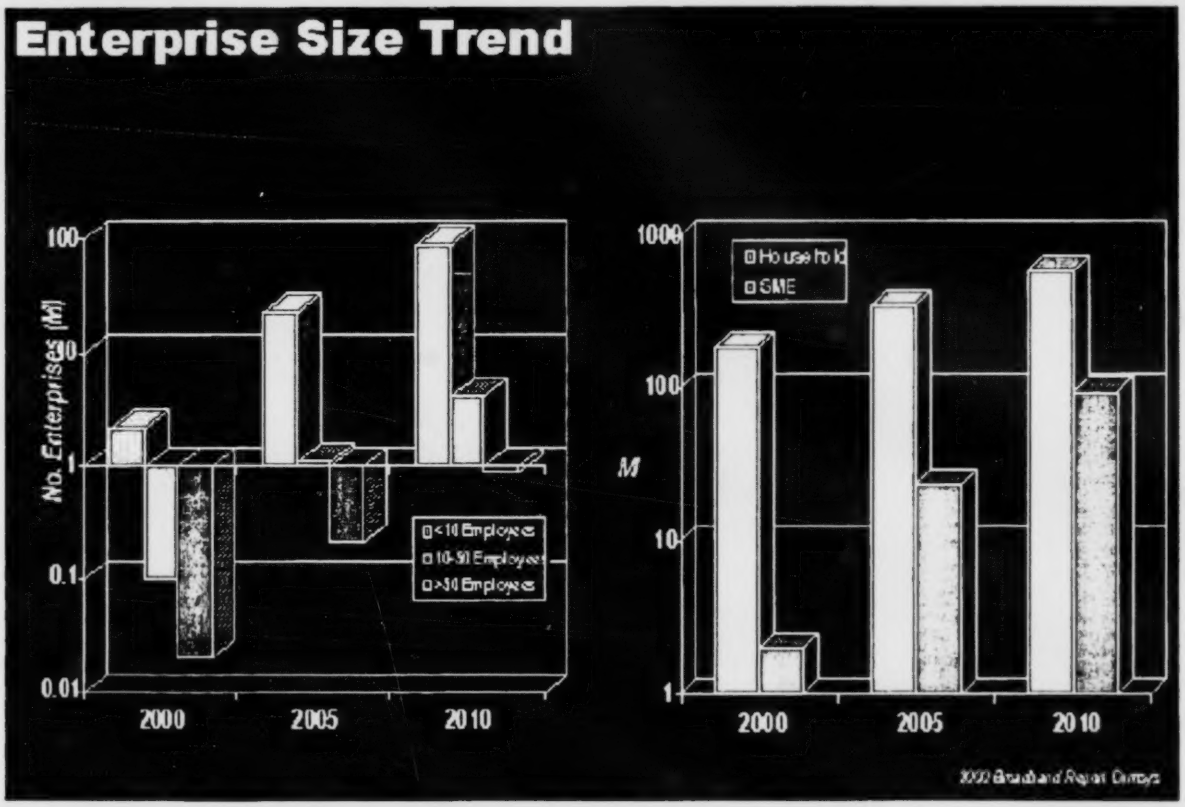
U.S.-centric and it's beginning to stall under the weight of demand. Further, we are now seeing the end of the internet beginning. The internet has evolved very rapidly from being a wonderful way to tie together individuals around the world to now becoming a necessity for business growth and economic expansion. As we rush to add bandwidth to address this problem, we also unleash a cycle of economic pressures, which will continue to further exacerbate bandwidth limitations, even as bandwidth becomes more available.

In short, it describes a cycle, which will require increasingly greater bandwidth and applications. Globalization of business will dictate being on-line or left out. Opportunities for electronic business commerce will thus grow. Improved software and business applications will grow to meet this demand. More intensive and frequent electronic transactions will result, and this will further require businesses to be on-line or left out.

On-line access for enterprises and households will be a necessity, which means it will increasingly become a utility. We will go globally from an inter-networked world dominated by personal connectivity to a truly e-commerce'd world where new applications will emerge, existing applications must improve, and essential service will require two megabits coming in and 500 kilobits going out.

Enterprise Size Trends



Let me go back to the commercial world for a few moments. Who are these enterprises? Are they GE, Lockheed Martin, Toshiba, China Telecom, and Daimler-Chrysler? Certainly, they will continue as market drivers, though most will likely change significantly. But they will change slowly as they always have. But another enterprise phenomenon will emerge in a very noticeable way. The SME (small and medium-sized enterprise) market accounts for a significant percent of all enterprises today in Western Europe, Latin America, and Asia, but still remains a relatively small driver on the global infocom market. This is expected to change dramatically over the next decade, fueled in large part by the cycle described above and by the sluggishness of large companies in the face of rapid change. By the year 2010, there will be nearly 100 million addressable SMEs globally, which compares to a little more than 2 million today. This

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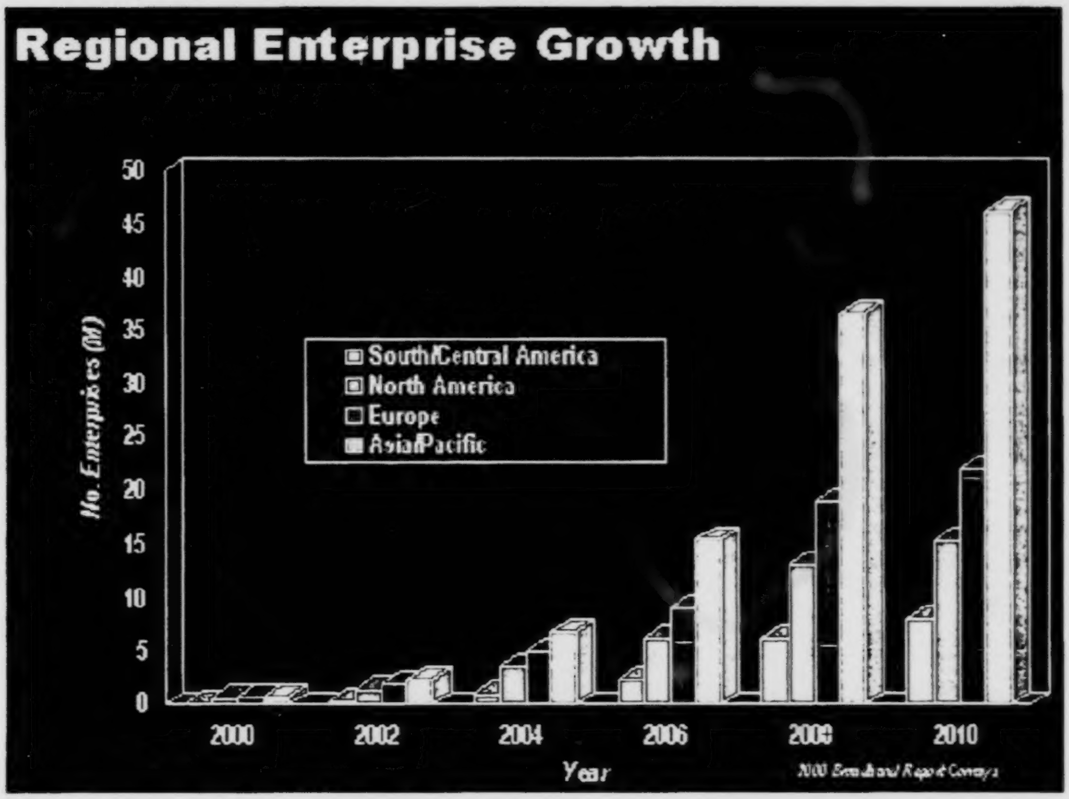
means that, in contrast to the nearly two orders of magnitude greater addressable households over SMEs today, the number of SMEs will rise to become fifteen to twenty percent the size of the global household market by 2010. This tends not to be the e-business market we think of today when we think of enterprises. The global addressable SME market reaches over $120 billion by 2010, not significantly smaller than the $450 billion household market.

Direction of Enterprise Growth



We spoke of a U.S.-centric internet earlier and that will continue to be a matter of fact for a some time. The predominance of web-hosted content will continue to be found on servers in the U.S. for some number of years and much of the build-out in developing economies will depend on gaining broadband access to this content. But the under-served SME market is not only growing, it's moving eastward away from the Americas as the European economy expands and as the huge Asia-Pacific economies begin to reach their true potential.

Necessities for Continued Growth

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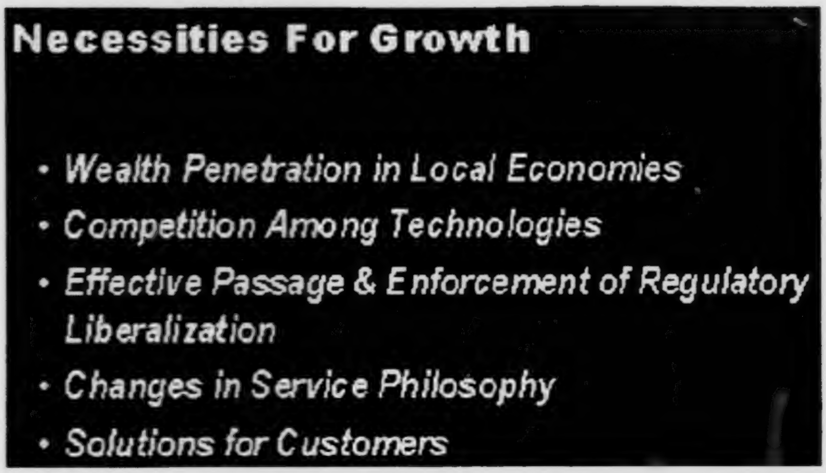
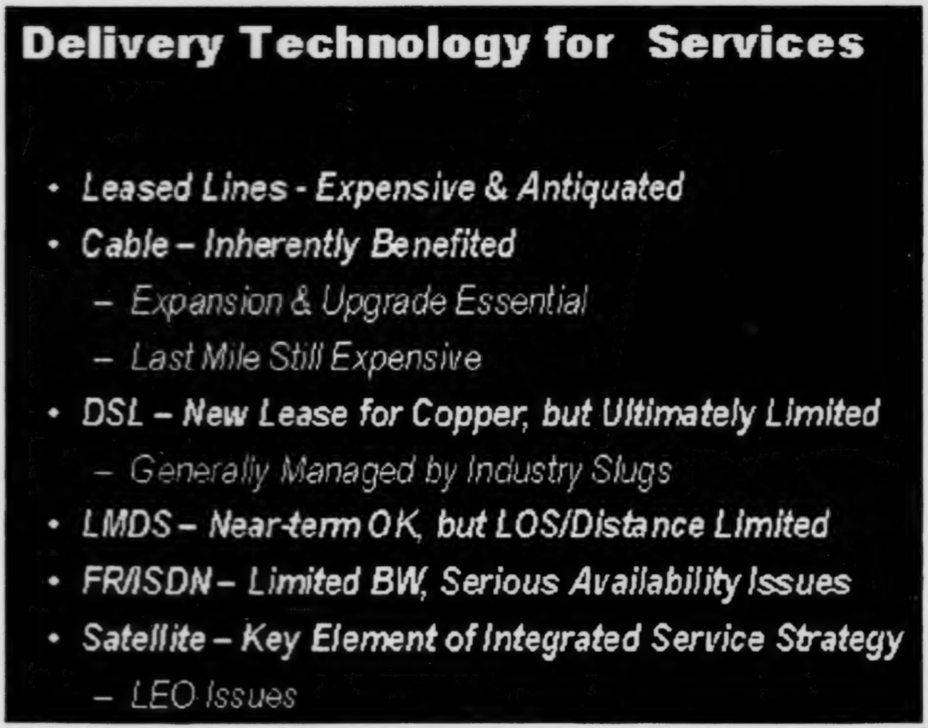


Necessities For Growth

- Wealth Penetration in Local Economies
- Competition Among Technologies
- Effective Passage & Enforcement of Regulatory Liberalization
- Changes in Service Philosophy
- Solutions for Customers

The characteristics of the most active broadband markets today include a number of factors essential for the growth forecasted. First, more enterprise and household wealth must continue to be created. Economic growth cannot stall very significantly. High competition among technologies such as cable versus DSL and satellite versus wireless must continue to offer alternatives. Regulatory reform must now shift to require both the passage and, more importantly, effective enforcement of legislation. Changes in service delivery philosophy will continue to differentiate those who measure themselves by Quality of Service (QoS), value-addition, flexibility, and availability instead of service price alone. Finally, service providers must provide fuller solutions for customers rather than fitting the customer to the partial solution they offer today. The days when service providers charge for access while telecom providers double up on the charges for long distance transport are over, as are transaction-based charges. The view of this as a telecom market instead of a consolidating computer, networking, entertainment, and software market is inevitably over.

Delivery Technologies



Delivery Technology for Services

- Leased Lines - Expensive & Antiquated
- Cable – Inherently Benefited
  - Expansion & Upgrade Essential
  - Last Mile Still Expensive
- DSL – New Lease for Copper, but Ultimately Limited
  - Generally Managed by Industry Slugs
- LMDS – Near-term OK, but LOS/Distance Limited
- FR/ISDN – Limited BW, Serious Availability Issues
- Satellite – Key Element of Integrated Service Strategy
  - LEO Issues

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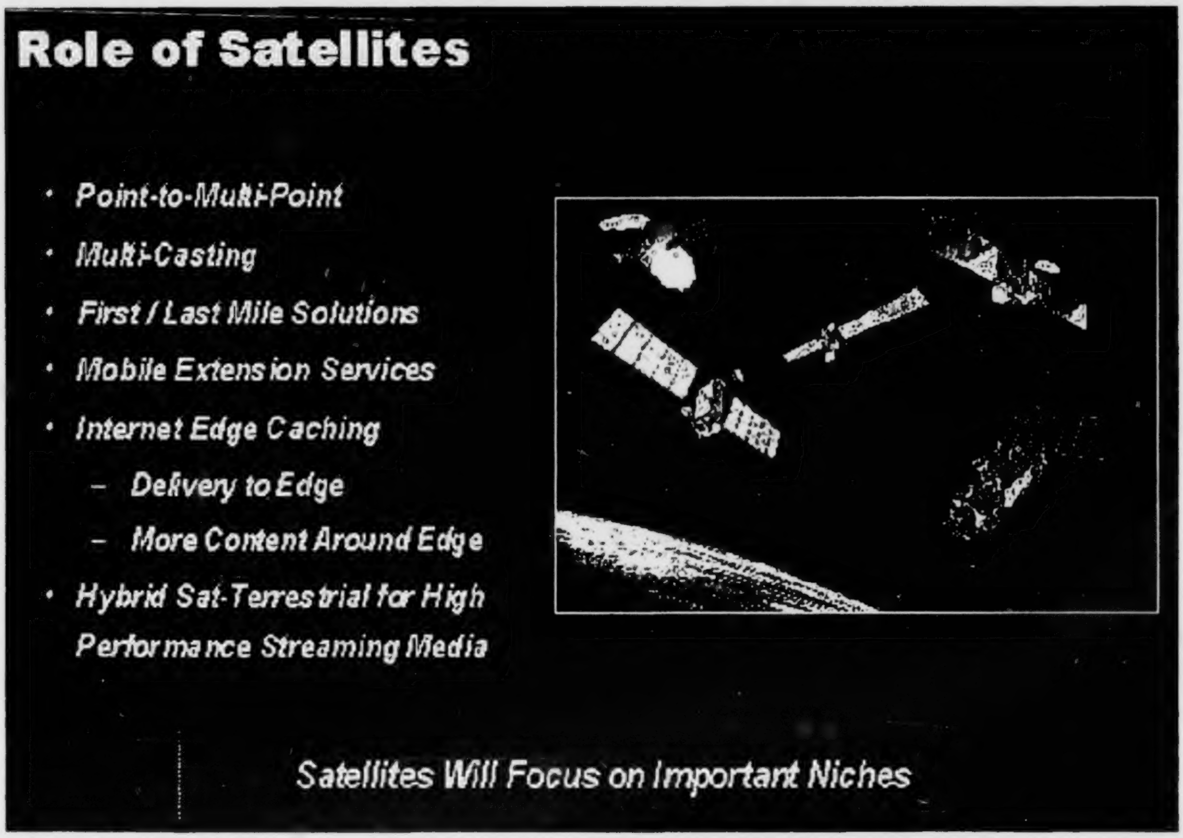
Today's common practice of leasing dedicated lines for enterprise use is quickly becoming an antiquated and expensive means of transporting data and supporting services and applications. Cable systems are inherently benefited with broadband capabilities and are in the early stages of enabling broadband expansion, though the current expensive efforts to expand and upgrade cable infrastructure is essential to take full advantage of this. And last mile to the curb will always be expensive. DSL is actually providing a new lease to the use of copper, but it is ultimately limited in bandwidth and requires relative proximity to switches. Further, DSL tends to be controlled by the slugs of the industry and thus less likely to respond at market speed. LMDS provides good bandwidth in the near term, but it's ultimately limited by line-of-sight and distance from the transmitter. Other technologies such as Frame Relay and ISDN can also provide near term bandwidth, but their availability remains a serious constraint. The extent to which these numerous technologies are actually available in markets, offering alternatives, the greater the growth of broadband services will be.

GEO-based broadband satellites are frequently seen as a service for those without alternatives, but this is nothing more than an unfortunate attitude. Certainly, satellites will play a greater role in developing markets, along with terrestrial wireless solutions. But, there is no reason to see it as a second rate service. In fact it will be an essential element of an intelligently integrated terrestrial-satellite service delivery strategy, as I described earlier. I do believe that GEO-based solutions will continue to be significantly more cost-competitive and far less constrained by localized capacity constraints than LEO/MEO-based solutions.

The Role of Satellites



Role of Satellites

- *Point-to-Multi-Point*
- *Multi-Casting*
- *First / Last Mile Solutions*
- *Mobile Extension Services*
- *Internet Edge Caching*
  - *Delivery to Edge*
  - *More Content Around Edge*
- *Hybrid Sat-Terrestrial for High Performance Streaming Media*

Satellites Will Focus on Important Niches

I am constantly amazed at this industry's ability to embrace convergence in many forms, but still keep terrestrial and satellite transport solutions in largely separate worlds. Clearly, with the rapid deployment of submarine and terrestrial optical routes, the ages-old mission of trunking via satellite, while still the largest source of revenue today for satellite fleet operators, is going to be replaced quickly by new and important niche missions. Forty-five billion dollars in

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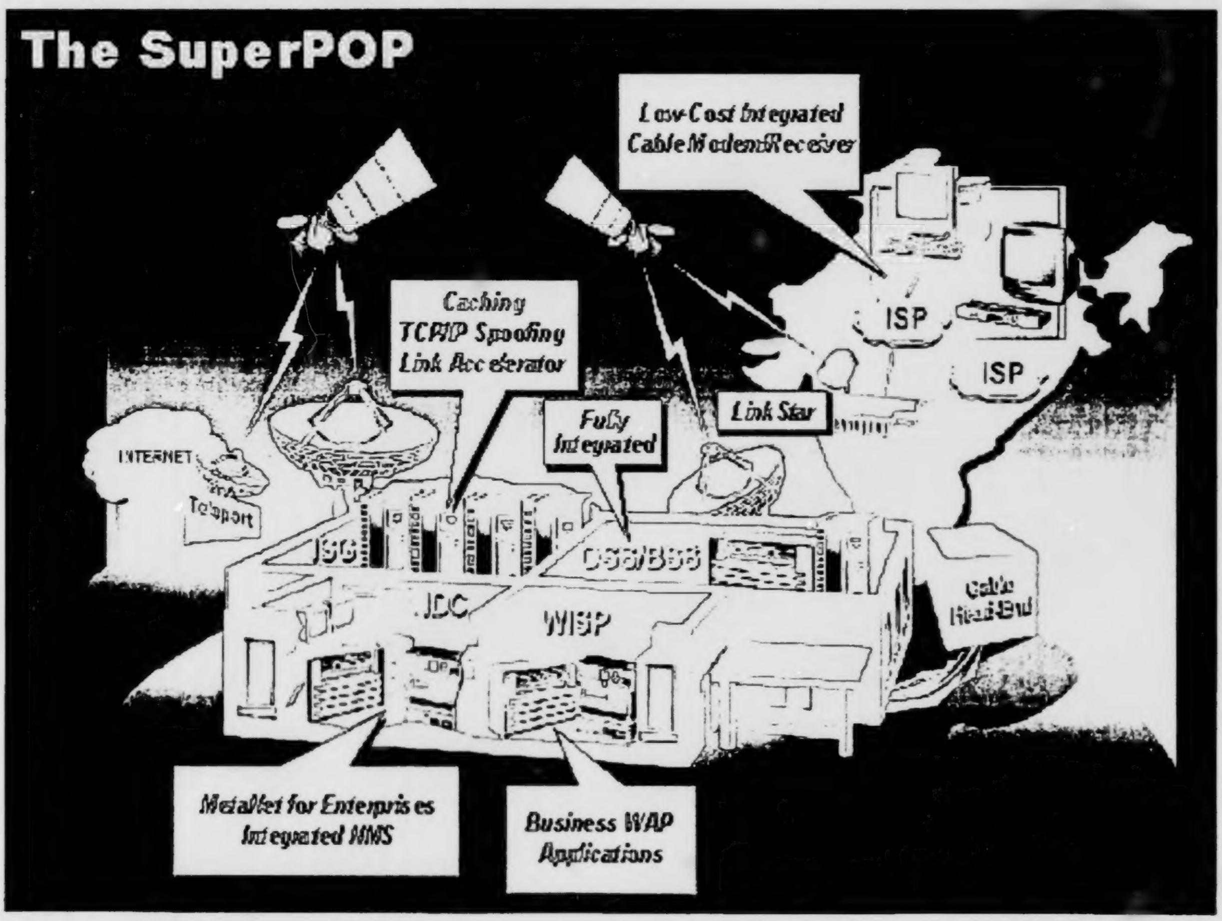
submarine cable investment from 1998 through 2005 is already driving transport prices in key long-haul routes down as much as sixty percent a year. Trans-Atlantic is already the most competitive route, followed by the Trans-Pacific route. At the same time, satellite transponder lease prices remain high, with only modest productivity, except in Asia, on similar trunking routes.

Satellite delivery will always offer advantages for specific situations where fiber and cable are simply too expensive, such as point-to-multi-point, multi-casting, and last mile. Mobile extension services like ACeS will also provide interoperable extension of terrestrial mobile services at competitive rates. To date, these have been driven by narrow-band voice and data services. Tomorrow, extension of enterprise data services and applications will be the driver. And the platform will become IP-based.

The explosive growth of the internet is now creating unique opportunities for satellite in an integrated satellite-terrestrial solution. Internet-driven satellite transport revenues amounted to slightly less than $200 million globally in 1999. By 2006, that same figure is expected to grow to over $8 billion. Near term, the greatest internet problem is that it remains congested in the core delivery locales. Caching to and around the edge of the core presents an excellent use of satellite services in the next few years and perhaps much longer. This is particularly applicable for delivery of static content and live events. Downstream, hybrid satellite-terrestrial networks are ideal for high performance streaming media as well as broader multi-casting applications such as enterprise e-mail broadcast, file distribution, software downloads, and training across multiple sites.

The SuperPOP Architecture for Developing Market Cyber-Carriers


The SuperPOP
Low-Cost Integrated Cable Modem/Receiver
Caching TCP/IP Spoofing Link Accelerator
ISP
ISP
Link Star
Fully Integrated
INTERNET
Teleport
ISG
DSS/BSS
IDC
WISP
Cable Head-End
MetaNet for Enterprises Integrated NMS
Business WAP Applications

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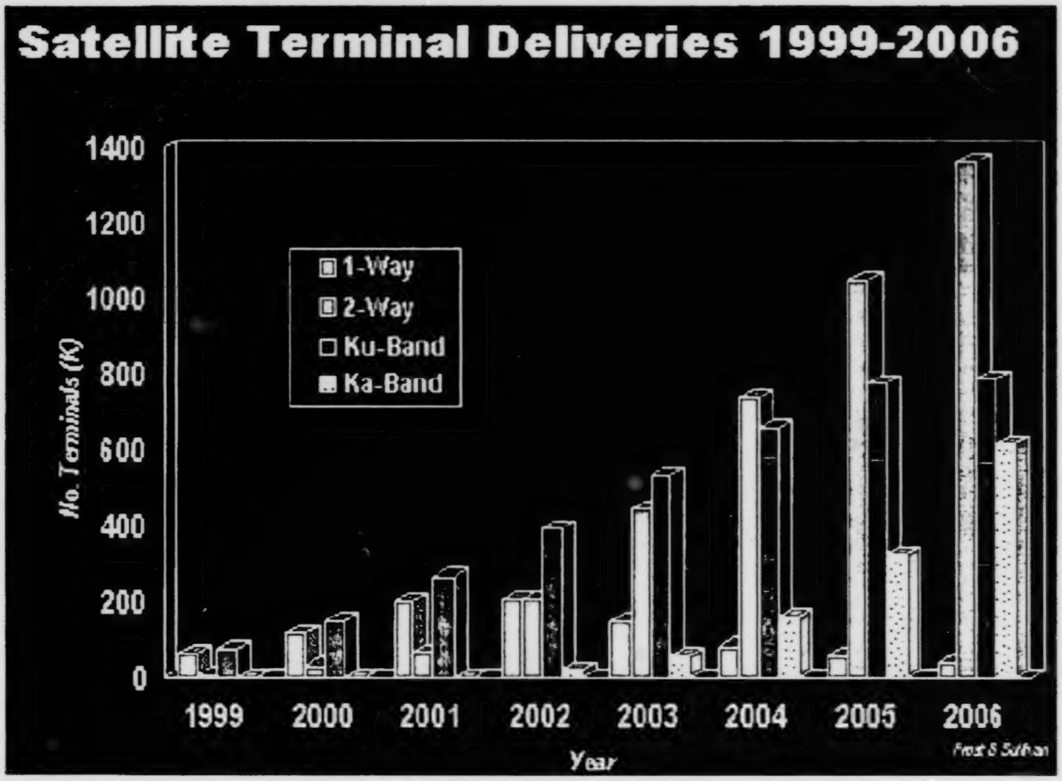
Many of today's enterprises in the most rapidly expanding regional economies still suffer from inadequate bandwidth and service availability. The need to provide broadband access coupled to internet data centers to support both managed network services and applications is now becoming extreme in many areas, even where optical networks are building out rapidly. We are now venturing with service providers in markets like India, China, South Africa, and Latin America to offer near-term solutions to this problem. The SuperPOP provides broadband satellite access via an international satellite gateway, internet data centers, wireless extension services, and integrated operations and business support functions. We're integrating these systems in our virtual Broadband Testbed. In this environment, we can evaluate the hardware and software products on the market, do some co-development with these suppliers, provide differentiating capabilities of our own, demonstrate solutions before delivery, and then stage deliveries to get our partners into service within weeks of finalizing the configuration.

Importance of Low Cost Satellite Access

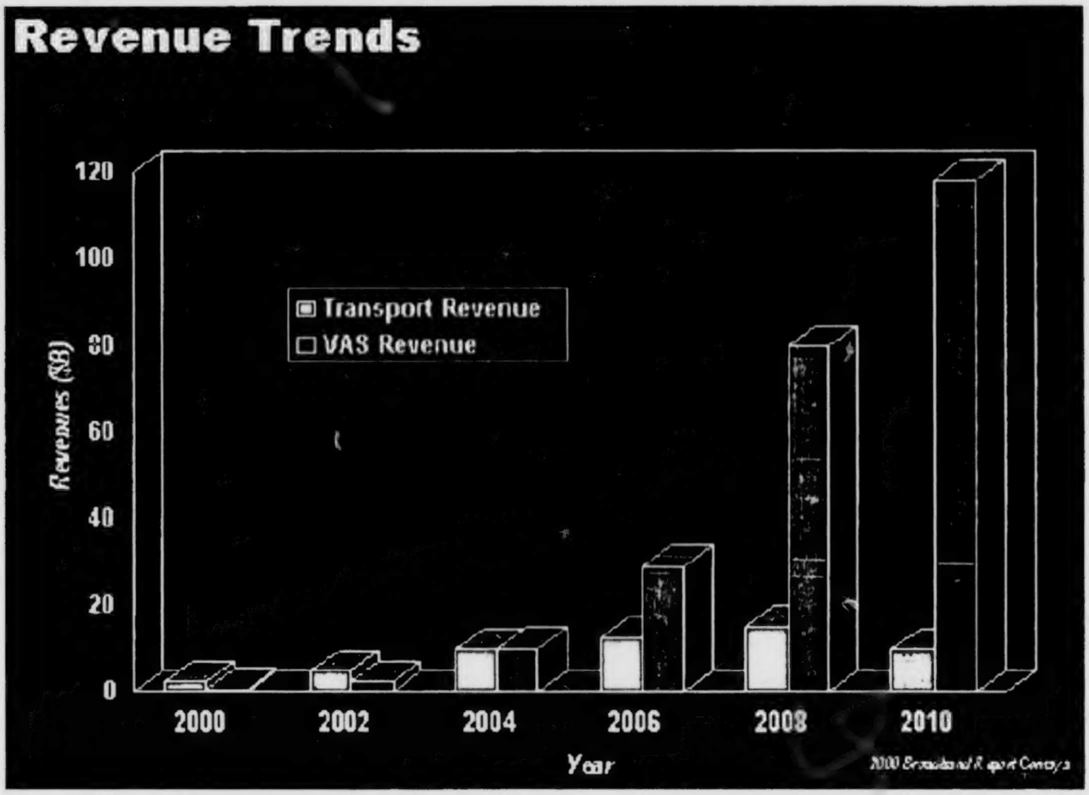


Means of access to the enterprise or household is also an important factor for future growth. Much of the world still has far more access via television than it does by even basic telephone service let alone cable modems, DSL, et al. The world of relatively narrow-band, one way satellite terminal access is likewise changing quickly. With the many issues associated with last mile access, not only to households but also to the exploding SME market, cost, availability, speed, and even line-of-sight for wireless systems will create a significant market for two-way satellite access. And while that seems to be near automatically associated with Ka-Band systems, it should be pointed out that high bandwidth, two-way access via bent-pipe Ku-Band systems will actually become the larger market in the next five years or so. A paramount consideration will be the cost of these terminals. It will be essential to provide cable modem/receiver devices, which look like the set-top box of today at $200 or less to allow access by the many subscribers who have primarily television services today.

We are working with terminal suppliers to develop very low cost integrated cable modem/receiver units and two-way flat-plate antennas to provide affordable access to SMEs, households, and remote sites of larger enterprises. We expect a $200 terminal to be available in early 2001 as well as an 18 inch two-way flat plate antenna for well under

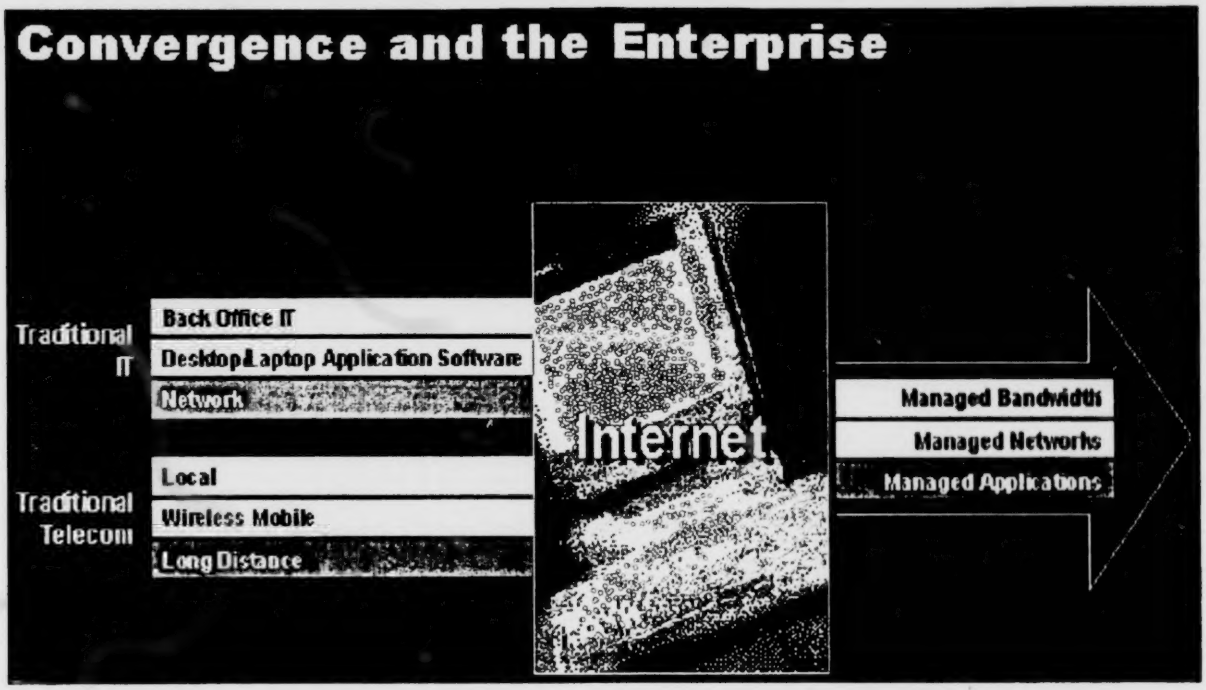
$100.

The Revenue Shift from Transport to Services



While competitive transport is an essential enabler for managed services supported by broadband networks, clearly the revenue stream will be generated by these value-added services rather than by the pure transport. This will certainly drive continued consolidation and alliances among transport, content, and service providers in the global industry.

Convergence of Traditional Telecom & Information Technology



Convergence and the Enterprise

Traditional IT
- Back Office IT
- Desktop/Laptop Application Software
- Network

Traditional Telecom
- Local
- Wireless Mobile
- Long Distance

Internet

- Managed Bandwidth
- Managed Networks
- Managed Applications

The "Killer Application" in this market is secure, affordable, powerful e-commerce, especially for the burgeoning SME market. Gathering market intelligence, performing sales and collecting payment on-line, managing purchasing and inventory, customer care, and managing necessary business processes is what enterprises need. The practice of buying these from many different providers (or performing them internally) and buying transport from even more providers is inevitably over. The need for enterprise productivity in a globally competitive market will drive this ever so quickly around the globe.

The traditional IT and telecom companies are, in varying degrees around the world, working toward converging services. While transport and access are important enablers for managed services and applications, it is becoming a very margin business and revenues themselves will erode soon as well. As larger enterprises continue to outsource infocom services to better focus capital and other resources and as the SME phenomenon continues, the value-added services will become the very network and application services so essential to enterprise productivity.

The New Service Provider

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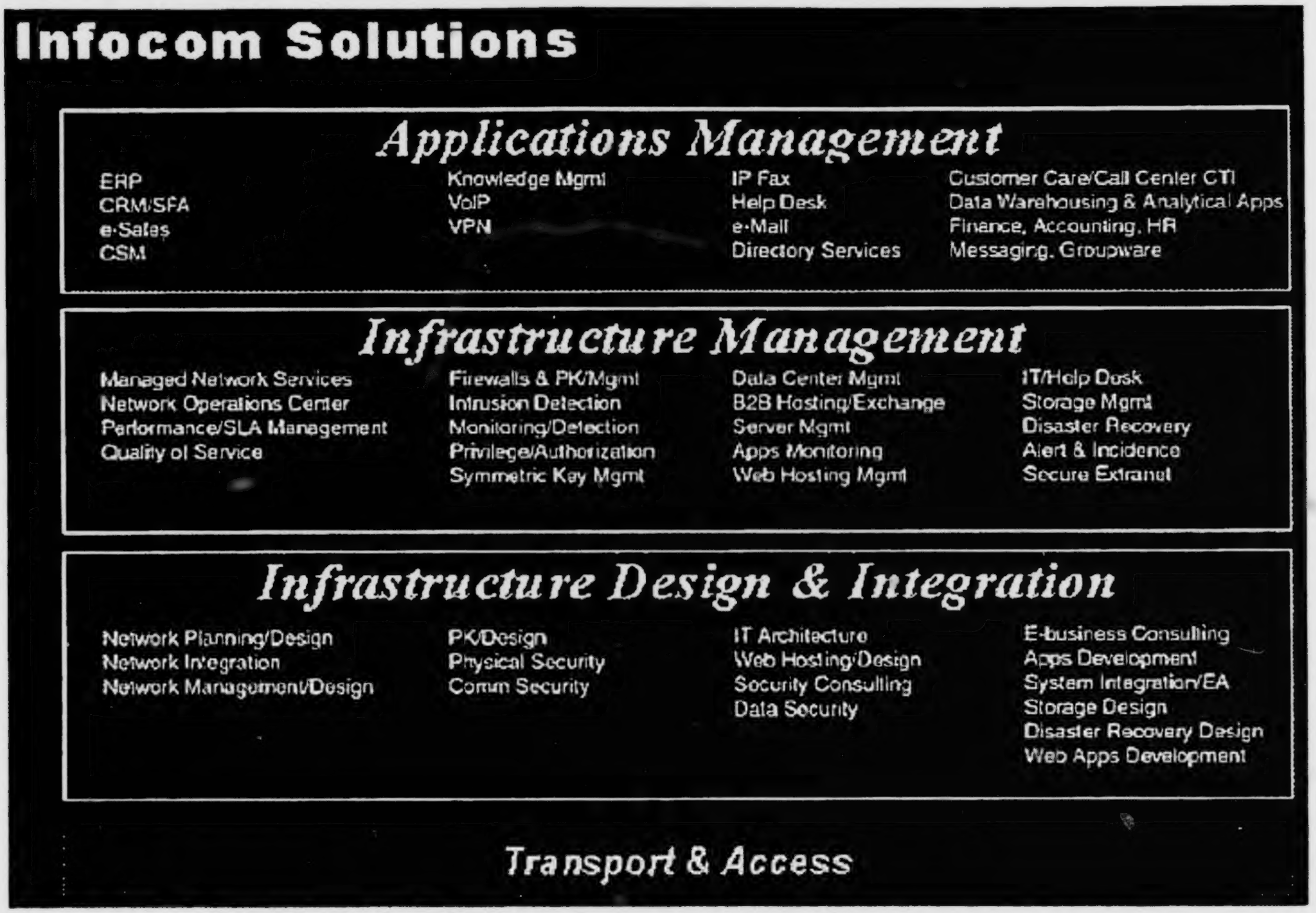

Infocom Solutions

Applications Management

ERP
CRM/SFA
e-Sales
CSM

Knowledge Mgmt
VoIP
VPN

IP Fax
Help Desk
e-Mail
Directory Services

Customer Care/Call Center CTI
Data Warehousing & Analytical Apps
Finance, Accounting, HR
Messaging, Groupware

Infrastructure Management

Managed Network Services
Network Operations Center
Performance/SLA Management
Quality of Service

Firewalls & PKI/Mgmt
Intrusion Detection
Monitoring/Detection
Privilege/Authorization
Symmetric Key Mgmt

Data Center Mgmt
B2B Hosting/Exchange
Server Mgmt
Apps Monitoring
Web Hosting Mgmt

IT/Help Desk
Storage Mgmt
Disaster Recovery
Alert & Incidence
Secure Extranet

Infrastructure Design & Integration

Network Planning/Design
Network Integration
Network Management/Design

PKI/Design
Physical Security
Comm Security

IT Architecture
Web Hosting/Design
Security Consulting
Data Security

E-business Consulting
Apps Development
System Integration/EA
Storage Design
Disaster Recovery Design
Web Apps Development

Transport & Access

A few companies like Lockheed Martin have been providing outstanding telecom and IT services for itself for many years. They are now taking these same system integration and application aggregation capabilities to the market in order to offer the same outstanding services to other enterprises that have been internal mainstays to their own companies.

The Need For Mobility

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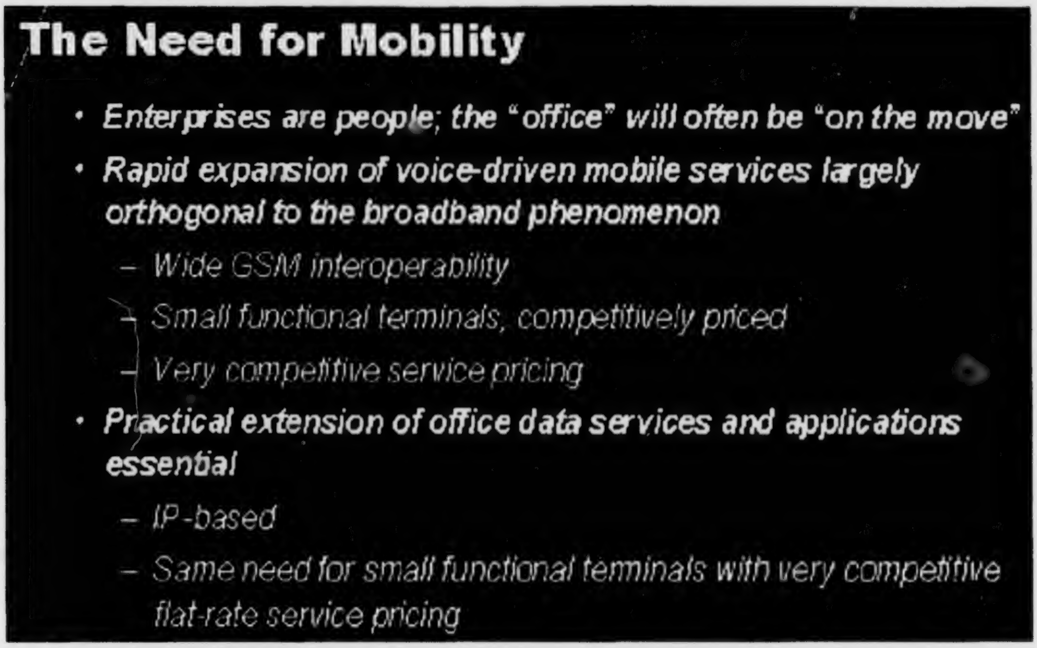

The Need for Mobility

- *Enterprises are people; the "office" will often be "on the move"*
- *Rapid expansion of voice-driven mobile services largely orthogonal to the broadband phenomenon*
  - *Wide GSM interoperability*
  - *Small functional terminals, competitively priced*
  - *Very competitive service pricing*
- *Practical extension of office data services and applications essential*
  - *IP-based*
  - *Same need for small functional terminals with very competitive flat-rate service pricing*

Enterprise infocom requirements are driven by the activities of its people. Those people spend less and less time in the traditional office, especially as SMEs become such a dominant factor in our world. The smaller the enterprise, the smaller the percent of its employees who sit in a traditional office. More will work in an office that sits in their home and looks a lot like a "household". Most will be "on the move" a good percent of their time.

Mobile services have more or less evolved on their own in recent years without being driven by the broadband phenomenon or the internet. The need for basic voice and narrow-band connectivity which is first, interoperable among many service providers' networks and second, priced right allowed the rapid growth of GSM networks around most of urban regions and the routes connecting them. What is now needed is a practical and affordable extension of the applications and data services required by enterprise employees when they are in fact "on the move".

As one obvious lesson learned from the several failed global mobile satellite ventures, the size and price and usability of the terminal for data and application extension outside the office is of paramount importance. The large antennas typical of mobile data terminals in operation and still envisioned for next generation services today just won't fly. Small, robust sub-notebook sized PCs with high processing power are going to be essential for this market. Similarly, even smaller PDA sized devices with usable displays and the computing power required for applications expected for the mobile internet will also be essential. The PC cards and antenna systems required to support this need to be developed in concert with next generation mobile computing systems to enable both terrestrial and satellite supported mobility. And the standards are not going to be evolutions of GSM, but rather they must be IP-based.

Summary

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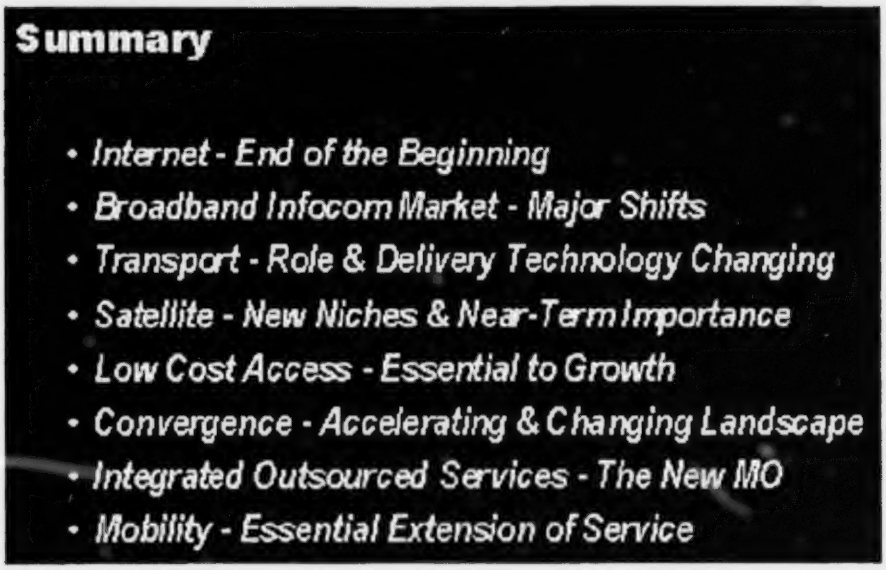

Summary

- *Internet - End of the Beginning*
- *Broadband Infocom Market - Major Shifts*
- *Transport - Role & Delivery Technology Changing*
- *Satellite - New Niches & Near-Term Importance*
- *Low Cost Access - Essential to Growth*
- *Convergence - Accelerating & Changing Landscape*
- *Integrated Outsourced Services - The New MO*
- *Mobility - Essential Extension of Service*

As I said earlier, we are now at the end of the Internet beginning. It is now the platform for global enterprise growth. The broadband market often infers primarily the dramatic increase in transport and processing bandwidth, but the true revolution will be associated with providing new productivity with better and more timely information. The nature and sizes of businesses are changing, as are their geographical locations. The need to keep financial and human resources focused on the strategic aspects of business will result in greater outsourcing of even business-critical infocom services, especially as enterprises become smaller.

Both the role and delivery technologies for transport are coming under fire and the margins on providing pure transport are under enormous pressure. Transport will become an essential enabler of managed network services and applications, but these new value-added services will soon dominate both revenue and earnings. Satellites continue to play an important role in increasingly niche situations and offer a near-term solution for satisfying growing cyber-carriers in developing markets. Low cost access is absolutely essential to this growth and there are creative solutions to provide this. The term convergence has almost reached cliché status with its frequent use, but it's a real phenomenon manifesting itself every day.

Outsourcing transport, infrastructure design, and the management of both telecom infrastructure and applications will become the new modus operandi. The cost of providing these essential enterprise functions can be reduced very significantly by placing these services in the hands of experts who can commit to reliability, quality of service, and security. And the services themselves cannot be limited to a fixed office environment, but rather extended through wireless IP-based systems.

Back to top of page **Back to the sessions page**

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Michael S. Williams

As president and general manager of the Systems & Technology business for Lockheed Martin Global Telecommunications, Michael Williams manages LMGT's systems engineering and integration and advanced technology efforts. Systems & Technology provides value-added system solutions for commercial and government customers worldwide in such areas as satellite and terrestrial network design, network and system integration, and installation, operations, and maintenance.

Prior to assuming this position upon the merger of LMGT and COMSAT, Williams served as senior vice president, network systems & ventures, and formerly as vice president of personal communications systems.

In previous positions spanning twenty-plus years at Lockheed Martin and its heritage companies, Williams has been responsible for overall line of business management, program management, business development and system engineering for space-based communications and remote sensing missions. His experience spans commercial, surveillance and civil applications. He also spent nearly 10 years as a systems engineer in aircraft/missile avionics systems.

Williams graduated from St. Joseph's University with a bachelor of science degree in physics, followed by a masters of science degree in electrical engineering from the University of Pennsylvania and an MBA from Temple University.

Back to proceeding page **Back to the sessions page**

Trends And Prospects For Commercial Launch Services

Bruce S. Middleton

Abstract

www.apac.com.au

INTRODUCTION

Up until 1999 the commercial GEO launch market was characterised by a shortage of launch capability, allowing prices to remain high and encouraging new investment. The year 1999 was however a watershed, and today the annual launch rate capability in this market segment exceeds demand and that excess is growing.

The market for commercial launches into to low Earth orbit (LEO) did not exist before 1997. In May 1997 the first Iridium satellites were launched, followed in August by the commercial Orbview-2 remote sensing satellite. Today however it is becoming clear that the LEO launch market is smaller than was expected, and highly competitive.

THE GEO LAUNCH MARKET

The number of commercial satellites requiring launch to GEO each year grew dramatically during the 1990s. In 1990 there were only twelve, but there were 27 in 1997, before the impact was felt of the Asian economic crisis. (I note in passing that in 1997 half of these satellites, 14 in total, were launched for service in the Asia Pacific.) One of the best available forecasts of future demand for launch services, to both GEO and LEO, is that prepared each year under the auspices of the US Federal Aviation Administration's Associate Administrator for Commercial Space Transportation (AST). This is prepared in the second quarter of each year by the US Commercial Space Transportation Advisory Committee (COMSTAC, which covers GEO launches) and the AST itself (which covers LEO launches), with assistance from Futron Corporation. My paper uses figures from the 2000 AST report ("AST report") for its demand estimates.[1]

Demand

In preparing the AST report's forecast demand for launches to GEO over the period 2000 to 2010, COMSTAC solicited US and international commercial satellite and launch companies for their payload plans and for projections of launch demand open to international competition. The AST forecast excludes launch requirements that are captive to national flag launch service providers.

To date, only Ariane has the capability to launch two satellites on a single mission ("dual manifesting"). However other dual payload launchers are expected soon to become available. COMSTAC took this development into account in converting its expectations of the number of satellites requiring commercial launch services into the estimated demand for launches. The forecast demand for launches to GEO over the period 2001 to 2020 is summarised in Table 1.

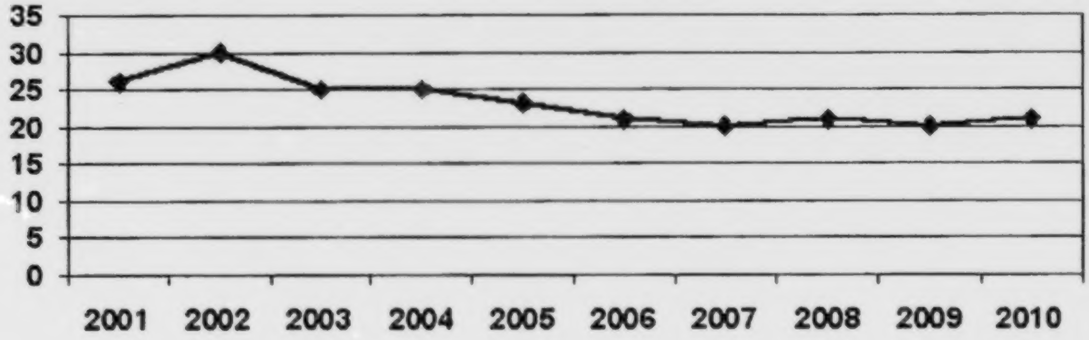
Table 1: Expected Commercial GEO Launch Demand, 2001 to 2010

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
LAUNCHES	26	30	25	25	23	21	20	21	20	21	232

Source: FAA

The effect of increasing capability for dual manifesting is clear in the expected decline of the number of launches over the period 2004 to 2007. This is shown graphically in Figure 1.

Figure 1: Expected Commercial GEO Launch Demand, 2001 to 2010



Source: FAA

My own view is that these numbers are possibly conservative. The large investments currently being made in intercontinental fibre optic cable networks, with capacity two orders of magnitude larger than current traffic, suggest strongly that future demand for bandwidth will dwarf anything the telecommunications industry has experienced to date. Satellites will be the preferred means of delivery of some of this traffic to end users, and the most cost effective mode for some new services such as interactive high bandwidth applications. There is a possibility that forecast launch numbers will prove low.

Supply

The following discussion concerns launchers normally used for carrying to geostationary transfer orbit (GTO) payloads with total launch mass of four tonnes and more. There are GEO launchers with smaller capacity in the market, but the demand for this class is small.

Ariane

Ariane-4 is capable of ten to twelve flights per year and can lift up to 4,520 kg to GTO. Ariane-4 will remain in service until 2004, until exhaustion of the 20 additional vehicles ordered in 1997.

The initial launch rate capability of Ariane-5 is five to six per year, but a rate of eight to ten per year is the declared early target.[2] Ariane-5 is being upgraded in stages from its current capability of 6,200 kg in a dual launch configuration. At the end of 2001 it should reach 10,00 kg GTO capability, and eventually 11,800 kg by 2005.[3] It will then be capable of carrying two five-tonne satellites on each launch.

While Ariane-4 remains in service, Arianespace will have a theoretical capability of about 20 launches per year (10 Ariane-4s and 10 Ariane-5s) prior to the phase-out of the older vehicle. I consider that optimistic given that Arianespace has never launched more than eleven vehicles per year (in 1997 and 1998). I estimate total Ariane capability for the time being at twelve flights per year, split roughly equally between the two vehicles.

Atlas

The annual capability of the Atlas-2AS is six to eight flights per year.2 The Atlas-3A, lifting up to 4,037 kg to GTO, flew successfully for the first time in May 2000. The Atlas-3B will fly for the first time in the fourth quarter of 2001, and will have a capability of 4,500 kg to GTO using the Centaur upper stage in a dual engine configuration. Atlas-3 (both models) will be capable of six to eight launches per year from Space Launch Complex 36B at Cape Canaveral Air Force Station (CCAFS).2 Options also exist to enable Atlas-3 capability from Vandenberg Air Force Base (VAFB) based on market requirements.[4]

Atlas-5 is to have GTO capability ranging from 4,950 kg to 8,650 kg. Atlas-5 will fly for the first time late in 2001 and become operational in 2002.

Atlas-5 will be launched from Space Launch Complex 41 at CCAFS and from Launch Complex 3W at VAFB. Only the Cape Canaveral site is suitable for GTO missions. No specific annual launch rate capability for the Atlas-5 has been revealed, the number being tailored to demand. Over the last three years all Atlas models have launched 25 payloads in total. I expect Lockheed Martin to increase the launch rate capability of the Atlas-3 and 5 models, and have assumed a capability of eleven Atlas flights per year.

Delta

The highest launch rate ever achieved with the current Delta-2 and Delta-3 launch system was 13 flights in 1998, eight from CCAFS and five from VAFB. (There were ten flights in 1999, seven from CCAFS and three from VAFB.)

The Delta-3 can launch 3,810 kg to GTO and is capable of four to five flights per year.2 . Its first two flights (in 1998 and 1999) were failures, but the problems have been rectified and Delta-3 successfully returned to flight in August.

Boeing is developing the Delta-4 with assistance from the US Air Force through the EELV program. The Delta-4 Medium and Medium-Plus models will be used for commercial launches, with GTO performance from 4,210 kg to 6,565 kg. The Delta-4 will fly for the first time late in 2001 and be operational in 2002. Delta-4 will replace Delta-3.[5]

Like Atlas, Delta flies from both CCAFS (Space Launch Complexes 17A and B and 37B) and VAFB (Space Launch Complexes 2W and 6W). Up to 17 launches per year of the Delta-4 are planned,2 though Delta-4 could have a capability of up to 26 launches per year using both CCAFS and VAFB.5 However only CCAFS is suitable for GTO launches, and this will be able to handle 17 Delta-4 flights in a single year.5

H-2A

Japan is developing its H-2A as a family of four different configurations with GTO performance from the Tanegashima launch site ranging from 4,150 to 7,500 kg. A future version is also planned, to be capable of up to 9,500 kg to GTO. The H-2A will have its first flight in the first quarter of 2001 and should become available commercially in late 2002 after the third proving flight. Initially the H-2A will be offered in three models. The agreement with fishermen that has limited the number of launches possible from the Tanegashima launch site is being modified, and the H-2A will be capable of six to eight launches per year.2

Long March

China's current heavy GTO launcher is the Long March-3B (CZ-3B), which flew for the first time (unsuccessfully) with a commercial payload in January 1996. It is capable of placing 5,200 kg into GTO from Xichang with minimum residue shutdown (5,100 kg for automatic shutdown).[6] China is studying an upgraded Long March-3B(A) with GTO capability of 7,000 kg.

The launch rate capability of the CZ-3B is estimated to be two to four per year.2 There were two flights in each of 1997 and in 1998, but none in 1999. To achieve four flights per year China will have to escape or overcome the impact of US export controls as they are currently applied.

Proton

International Launch Services (ILS) has invested in a new satellite processing facility and Proton launch pad at Baikonur, raising Proton capability to eight launches per year. Current manufacturing capability is 13 Protons per year, but some of these are required for Russian launches and the commercial capability is seven to nine flights per year.2 Seven Protons were launched in 1998 and eight in 1999.

Khrunichev has developed the Proton-M upgrade that will initially be capable of 5,500 kg to GTO, and ultimately 7,800 kg, including dual payloads. Proton flew with the Breeze upper stage in June 2000 and Proton-M is expected to fly for the first time commercially in late 2000 or early 2001. Proton-M will have a planned annual capability of eight to ten flights, and the older Proton will scale back to two to five per year once the M model is in service.2 I assess Proton's commercial capability as that of Baikonur, namely eight commercial launches per year.

Sea Launch Zenit

Boeing's Sea Launch Zenit-3SL is capable of 5,250 kg to GTO when launched from a location near (the mid-Pacific) Christmas Island. Upgrading is planned to achieve 5,750 kg by 2002.[7] The annual launch rate capability of the Zenit-3SL at present is up to six per year, but Sea Launch expects to reach seven to eight per year next year and is studying the possibility of reaching ten launches per year.

The table below summarises estimated global annual launch rate capability for ELVs in this performance class by 2002.

Table 2: Global Annual Launch Rate Capability by 2002, Four-Tonne to GTO Class Launchers

Ariane	Atlas	Delta	H-2A	Long March	Proton	Sea Launch	TOTAL
12	11	17	8	4	8	8	68

Source: APAC

These numbers represent annual launch rate capability, not the number of satellites to be launched. Taking account of the dual manifest capability of Ariane-5 and Proton-M, the number of satellites that could be launched per year into GTO could exceed 80.

Somewhat surprisingly, even more capacity is being planned. Khrunichev is developing the Angara family of launchers, two models of which will have GTO capability of 6,800 to 8,00 kg. Angara-3A will be a Zenit-class vehicle, while Angara-5 is intended to replace Proton. Annual launch rates are unknown at this point. Although a first core stage for Angara has been assembled, it is not known when this vehicle might enter the commercial market.[8]

The Australian company Asia Pacific Space Centre last year announced its intention to commence commercial flights from (Indian Ocean) Christmas Island using the Aurora launcher being developed by Khrunichev. Aurora is to have a capability to GTO of 4,500 kg and the first test launch from the new site is planned for April 2003.[9] There must be doubt whether this venture will actually enter the GEO launch market, but if it does it will add to the pressure.

Supply and Demand

Based on the numbers in Tables 1 and 2 and the developments expected in the next few years, there already is and will continue to be a substantial surplus of launch capability over expected demand. This conclusion takes into account a small government demand in addition to the commercial market. The supply side of the commercial market amounts to a capability up to 68 flights per year, potentially rising in future years. The forecast demand however is for 20 to 30 flights per year, representing a potential over-supply in excess of 100%.

Launch service providers in this market segment are already feeling pressure on prices. Most have some capacity to respond. Arianespace will be able to offer competitive prices for larger satellites on the Ariane-5 once its dual-manifest capability is increased to ten tonnes. Around 2002 the two American commercial derivatives of the EELV (the Atlas-5 and Delta-4) should come into service. The US Air Force target is for the medium lift EELV to achieve 25-50% reduction in costs, and Boeing expects to achieve cost reductions for the Delta-4 up to 20% below current levels. So long as the oversupply continues, customer pressure to reduce launch costs will have an impact. In consequence I expect that the price of commercial launches to GEO to drop further by 2005.

Potential annual launch rate capability is not the same as the minimum level of orders required to keep manufacturing lines open. Nonetheless there is reason to agree with Will Trafton, President of Sea Launch, who was quoted in May as forecasting the possibility of a shake out in three to five years.[10] It is not clear however how that will play out. Most of these launch systems would probably remain available even if they won no commercial orders, due to the determination, and the requirements, of the respective governments. This is certainly true of Ariane, H-2A, Long March and Proton (and their successors). It is probably also true of Delta, which has captured the major portion of EELV launch contracts from the US Air Force. Atlas, with less government business, would seem to be in a weaker position. Moreover the Ukrainian Government would not be in a position to support Zenit production to the benefit of Sea Launch.

THE LEO LAUNCH MARKET

Prior to the demise of Iridium the LEO constellations were seen as an attractive opportunity for commercial LEO launch service providers. More LEO constellations were planned (eg Constellation with 46 satellites, Ellipso with 16, Celestri with 63, SkyBridge with 64 then 80, and Teledesic with 288). There were many more proposals for little LEOs, big LEOs and broadband LEOs, all requiring replenishment launches.

In consequence new LEO launchers were developed for commercial service, such as Lockheed Martin's Athena and Orbital Sciences' Pegasus and Taurus. At the same time existing Chinese and Russian launchers in this class were offered for commercial use. During the 1990s, and as the new market came closer, more than a dozen other proposals for new LEO launchers emerged. Then there came into the market a group of launchers based on decommissioned missiles developed by the former Soviet Union.

Demand

The commercial failure of Iridium in August 1999, the bankruptcy protection filings by ICO in September 1999 and by Orbcomm in September 2000, and the ongoing struggle by Globalstar to achieve viability, have caused a reassessment of LEO prospects and of the LEO launch market. The assessment of the LEO launch market by the AST in the first half of 2000 was more sober than in past years.1 Nonetheless the AST report's "baseline" scenario still provides for two little LEO systems additional to Orbcomm, one big LEO system additional to Globalstar, and one broadband system. Today even that looks distinctly optimistic. The AST report's "robust" scenario would add one more system to the baseline in each class of LEO. That now looks even less likely. I have therefore taken the baseline scenario as the basis of my assessment of demand, while recognising that this is probably optimistic.

The LEO launch market is more diverse than that to GEO, with a wider range of vehicle capabilities tailored to a range of launch masses and orbits. There is not time in this short paper to canvass them all, so I have focussed on one market segment. This is the segment currently dominated by the small Delta rockets, the 732X and 742X models, which represent the benchmark in this market. In calendar 1999 they performed seven of the ten flights in this class, notwithstanding prices generally amongst the highest in the class.

At present there are three operational LEO launchers that compete directly with these Deltas in performance, the Dnepr-1, Long March-2C and PSLV. The performance of the Delta models and its current competitors is given in Table 3.

Table 3: Performance Comparison between the Deltas and Competitors (kg launch mass)

Orbit	400 km altitude, circular		
	28 deg	50 deg	90 deg
Dnepr-1	0	3,200	2,450
Delta-7320	2,600	na	1,880
Delta-7420	2,880	na	2,220
Long March-2C	2,490	na	1,300
PSLV	0	2,660	1,640

Source: User's Guides

My company maintains its own "mission model" for the LEO market. This lists all satellites requiring launch to LEO in the period 2001 to 2010. The model was developed from our own databases and augmented with inputs from a number of other sources including Euroconsult,[11] Teal Group[12] and the AST report1 . Our model includes replenishment missions and omits missions generally inconsistent with the AST report.

Our model lists 600 satellites requiring launch to LEO in the period 2001-2010, that are likely to be launched by contractors selected as the result of competitions open to international launch service providers. (This compares with the 522 payloads between 2000 and 2010 in the AST report's "baseline" scenario and 685 in its "robust" scenario.) From these 600 we identified those missions potentially in the small Delta class. We scrutinised each mission and identified those compatible with multiple manifesting, to give an estimate of the demand for launches in this class.

The resulting estimated demand for flights in this class is summarised in Table 4.

Table 4: Commercial LEO Launch Demand in the Small Delta-Class, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Number of Launches	3	5	4	4	5	4	5	8	1	10	49

Source: APAC

Given recent developments I think these numbers are perhaps optimistic. My reality check is calendar 1999, when there were ten flights in this class. Iridium conducted one launch on Long March-2C and there were four Globalstar deployment missions on Delta-7420. There was only one other commercial flight, of UoSat-12 on Dnepr, making a total of six commercial missions. All the remaining flights were of government-funded missions and were not available for international bidding. The Iridium flight will not be repeated and the Globalstar deployment flights will be replaced by replenishment missions at a steadier rate. That suggests that the "ongoing" element of launches in 1999 was perhaps three. An estimated market averaging five missions a year, small though it appears, is larger than the ongoing (as distinct from one-off) commercial market in this class in 1999.

Supply

There are five operational launch vehicles currently competing for this market. More are in development, including the Kistler K-1 and the Russian Unity ULV-22 and Angara-1.2.

Delta 732X and 742X

McDonnell Douglas (now Boeing) developed the 732X and 742X families of LEO launchers to address two markets, the replenishment of commercial LEO constellations and launching NASA's medium-light (MedLite) class of satellites. As noted, Boeing achieved seven flights of these models during 1999. The annual capability of all the Delta-2 models, including 792X models, is ten to twelve per year.[2] I believe that Boeing could sustain a rate of seven per year for the 732X and 742X if the demand existed, and I therefore assess the annual launch rate capability of these Delta models as seven.

Dnepr

The Dnepr (based on a decommissioned SS-18 "Satan" missile) had its first commercial launch in April 1999 carrying the British UoSAT-12 satellite. Dnepr is cheaper than other launchers in this class (including the quoted price of Kistler's K-1). Kosmotras, its marketing company, claims capability for launching up to 28 Dnepr vehicles per year, consistent with a public "possible" figure of 25-27.2 However only one launch took place during 2000, and there are plans for two more late in 2001.[13] I have used five per year as a working figure for 2003 rising to 20 per year in 2007, the last year in which the SS-18 vehicle will be available under the START II Treaty.

Long March-2C

The Long March-2C first flew successfully in 1975, and was offered for commercial use in 1985. It has flown successfully 19 times in succession, including 13 commercial payloads, twelve of those Iridium satellites. The nominal flight rate of the Long March 2C is not known, but four per year is the maximum so far achieved, in 1998.

PSLV

India's PSLV (Polar Satellite Launch Vehicle) has been available for commercial service since 1998. The only non-Indian payloads launched to date are Kitsat-3 and Tubsat, both secondary payloads to IRS-P4 in May 1999. A further PSLV flight is expected in the first quarter of 2001, carrying the Indian IRS-P5 satellite. Given the recent flight record of the PSLV and its slow commercial progress, I assess its annual capability as one flight.

Table 5 summarises my estimates of the annual launch rate capability of currently active launch systems in this class.

Table 5: Annual Launch Rate Capability of Active Systems in the Small Delta Class, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010

CZ-2C	4	4	4	4	4	4	4	4	4	4
Delta	7	7	7	7	7	7	7	7	7	7
Dnepr-1	2	3	5	8	12	16	20	0	0	0
PSLV	1	1	1	1	1	1	1	1	1	1
Launches Available	**14**	**15**	**17**	**20**	**24**	**28**	**32**	**12**	**12**	**12**

Source: APAC

There are several LEO launchers in this class currently in development, including the American Kistler K-1 and the Russian Angara-1.2 and ULV-22.

K-1

Kistler is developing a reusable system, but progress has stalled for lack of funds. The company plans to launch seven, 13 and then 21 missions of its K-1 reusable launcher from Woomera in South Australia in its first three years of operations, and a maximum launch rate of 52 per year is proposed. Based on the difficulty Kistler is experiencing in raising funds for several vehicles and two launch sites, I estimate Kistler might be capable of launching four times in 2003 rising steadily to 24 in 2009. However if the K-1 proved more successful, and if the market existed, it could provide 30 or 40 launches per year off pads at Nevada and Woomera.

Angara-1.2

Angara is a family of launchers being developed by Khrunichev. The two smallest versions, 1.1 and 1.2, are designed as LEO launchers, and the 1.2 compares with the small Deltas with a capability of 3,400 kg to 200 km at 90° inclination. First flight of the Angara-1.1 is expected late in 2001 and the 1.2 some time in 2002.2

No annual launch rate for Angara-1.2 is known, but given that Angara-5 will replace Proton and the 1.2 model will use the same core module, the potential exists for a significant number of vehicles to be built each year. I have taken five as a modest guess, based on the current production capability of thirteen Protons per year.

ULV-22

United Launch Systems International (ULSI) of Australia is working with the Russian Aviation and Space Agency, State Rocket Centre Miass and other Russian parties to develop the Unity ULV-22 launcher based on Energomash's RD-120U and RD-0136 engines. The ULV-22 will be capable of launching around 4,700 kg into a 400 km orbit. Subject to successful conclusion of ongoing contract negotiations, the first commercial flight could be in 2005.[14] The infrastructure, to be based near Gladstone in Queensland, is to be capable of twelve flights per year.

Table 6 summarises, for the years 2001 to 2010, my estimates of annual launch capability for these three launchers in development.

Table 6: Estimated Launch Rate Capability of Planned Systems in the Small Delta Class, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
K-1	0		4	7	10	14	17	20	24	24
ULV-22	0	0	0	0	1	3	5	8	12	12
Angara-1.2	0	0	1	3	5	5	5	5	5	5
Launches Available	**0**	**4**	**5**	**10**	**16**	**22**	**27**	**33**	**41**	**41**

Source: APAC

Supply and Demand

Table 7 summarises the expected demand for launches in this class with the annual capability of vehicles already operational and active in the commercial market.

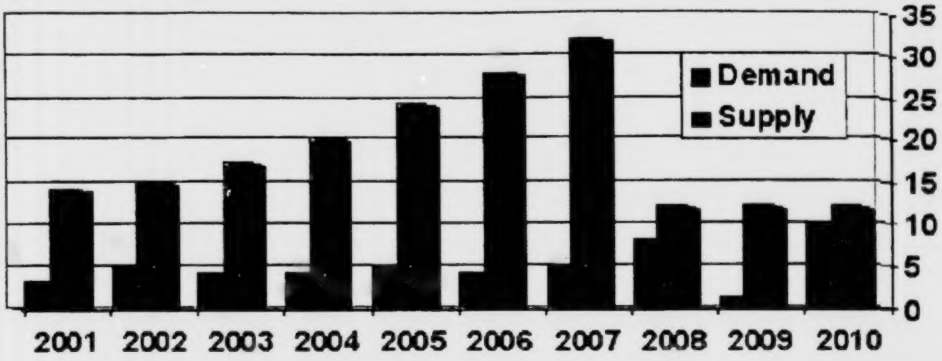
Table 7: Expected Commercial Demand for and Supply of Launch Services in the Small Delta Class, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Demand	**3**	**5**	**4**	**4**	**5**	**4**	**5**	**8**	**1**	**10**	**49**
Supply	**14**	**15**	**17**	**20**	**24**	**28**	**32**	**12**	**12**	**12**	**186**

Source: APAC

This result is shown graphically in Figure 2.

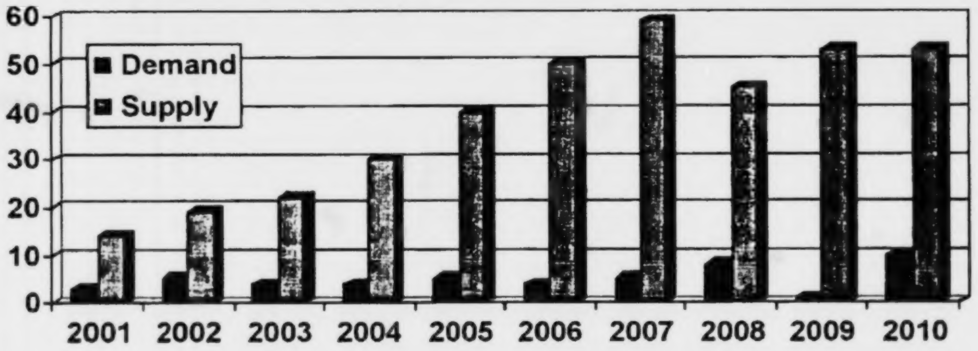
Figure 2: Expected Commercial Demand for and Supply of Launch Services in the Small Delta Class, 2001-2010



This analysis indicates that in this market segment the capability of competing vehicles (excluding vehicles under development) will greatly exceed the demand throughout the period 2001-2007. Even after Dnepr vacates the market in 2007 an excess of supply is predicted. Note that this refers only to launchers already in operation.

This describes a discouraging prospect for the additional launchers in development in this class. If their estimated annual capability is added the imbalance is even more stark, as Figure 3 shows.

Figure 3: Possible Commercial Demand for and Supply of Launch Services in the Small Delta Class, 2001-2010



This chart illustrates that the planned service entry date of Kistler's K-1 and ULSI's ULV-22 will initially exacerbate the effect of the Dnepr capability, then preserve the gross imbalance between demand and supply even after the Dnepr vacates this market segment in 2007.

I conclude that there is likely to be a substantial excess of supply over demand for launches in the small Delta class over the period 2001 to 2010.

CONCLUSIONS

It is clear that, on current demand and supply forecasts, both the GEO and LEO commercial launch markets are going to be highly competitive over the coming decade. There will be pressure on prices, and therefore on costs, always against the background that customers and insurers demand reliability. There will probably be a shakeout in both market segments.

Launch services customers select their providers on the basis of three primary factors: price, reliability, and customer responsiveness.

Pressure on prices will demand cost cuts while maintaining reliability. In the GEO market it is the new generation of launchers – Ariane-5, Atlas-5, Delta-4 and Zenit-3SL – that will have the lowest costs. Because of government orders and support, Ariane, Delta, H-2A, Long March and Proton (and their successors) are likely to remain available regardless of the commercial outcomes. There is likely to be more pressure on the Atlas and Sea Launch Zenit.

In the LEO market, the low cost position is occupied by the vehicles derived from the Soviet missiles taken out of service under the START II Treaty. Until they are required to be destroyed by the end of 2007, customers primarily influenced by price will gravitate to these vehicles. However many customers will recognise program risk in the potential difficulty of obtaining and retaining export approval to transport satellites to China and Kazakhstan for launch on Long March or Dnepr. Some customers tempted by the low prices for these launchers are likely to take their business elsewhere to avoid this risk. It can be concluded from the market share currently enjoyed by the reliable but expensive Delta that most customers are more influenced by reliability than cost.

I expect the primary determinants of market success for launchers in this new market to be reliability and responsiveness to customers, not price.

This competitive commercial launch market is a new environment for traditional launch services companies. It is putting the service providers under new discipline for all the factors customers regard as important. Prices will come down, technology, capability and reliability will improve, and customers will get the attention they want but feel they have not always received

End notes

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Back to proceeding page **Back to the sessions page**

The Multimedia Migration: Transponder Versus Processing Payload VSAT Networks

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Abstract

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1. SUMMARY

A previously published TRW paper [1] has demonstrated that multi-beam processing payloads offer significant business advantages to top-level network service providers (NSPs). From a network service provider perspective, the increase in effective satellite capacity and billable bits is a key differentiator of processing payloads relative to traditional transponder payloads. The success of any business relies on its ability to attract customers. For NSPs using processing payloads to be successful, users (i.e. network managers) must be convinced that implementing their networks through a processing payload system offers an advantage over transponder-based systems. It is therefore worthwhile to explore processing payloads from a user perspective.

With their flexibility, increased capacity, and performance benefits, processing payloads will open the door for many exciting new broadband multimedia applications. Skeptics may argue that it is risky to base a business case on the availability of new applications. Will there be user demand for processing payload systems when they are deployed? To answer this question, it is important to remember that there is a profitable, vibrant, and growing VSAT market present today. What is sometimes understated is that processing payloads are not only an enabler for future applications, but they offer distinct advantages for existing VSAT applications.

This paper compares the user costs of a typical VSAT network using existing transponder technology to the same network implemented using TRW's Gen*Star processing payload technology. Unlike proposed future applications for which no quantitative data exists, the properties of existing VSAT networks are well known and can be easily evaluated. The results demonstrate that processing payloads represent a superior solution for both today's VSAT networks and for the more sophisticated applications and network topologies inevitable in the future.

2. REVIEW OF VSAT NETWORKS

VSAT networks are characterized by small interactive stations with antennas typically less than 2 m in diameter. With approximately 500,000 interactive sites operating world wide, VSAT networks have become an accepted and growing means for meeting corporate communications needs. Key advantages driving this growth are:

- VSAT services are available nearly everywhere in the world
- Rapid deployment
- Sites easily added or removed from a VSAT network
- Costs often much lower than terrestrial alternatives for equivalent data rates andgeographic distribution of sites
- Connection costs are distance-insensitive
- Highest level of service availability among all communication alternatives (typically > 99.9%)

2.1 VSAT APPLICATIONS

Interactive VSAT networks have penetrated a wide cross-section of business, government, and scientific applications. Initially, corporate users found VSAT networks to be financially attractive relative to leased lines from the telephone companies. Large VSAT networks are now employed by corporations to provide better data collection and information dissemination to geographically dispersed facilities. Figure 1 lists several important industries that use VSAT networks and the services they provide. In general, these applications involve many geographically distributed terminals. Although some networks provide voice communications, most VSAT networks provide data services that are somewhat less sensitive to transmission delay.

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Figure 1. VSAT Applications

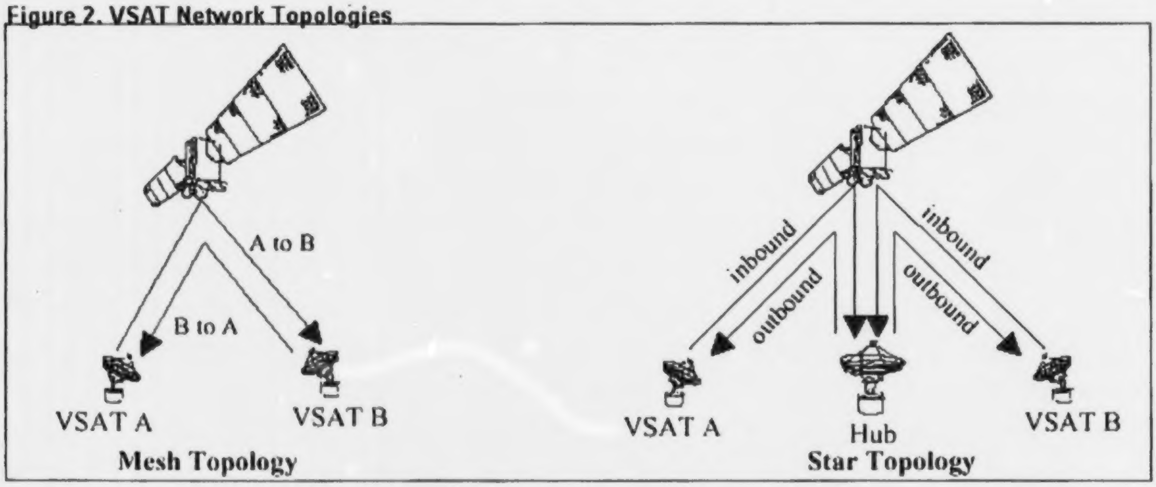
Industry	Services	
Banking	• Automatic teller machines • Transaction support, database access	• File/software updates • Branch bank automation • Teller services
Retail	• Credit authorization • Point of sale • Pricing updates	• Inventory control • Video promotions • Frequent buyer programs
Transportation	• Inventory control • Fleet management • Shipment tracking	• Order entry • Credit authorization
Financial Services	• Brokerage service • Electronic payment transactions	• On-line trading • File/software updates, data base access
Energy	• Pipeline monitoring • Power line monitoring	• Communication to drilling sites
Miscellaneous	• Internet access • Corporate email	• LAN internetworking • Distance learning

2.2 TECHNICAL CHARACTERISTICS OF VSAT NEWORKS

Three key elements that define a VSAT network architecture are the network topology, data rates supported, and multi-user access scheme. The two basic network topologies for VSAT networks are star and mesh (Figure 2). In the mesh topology, VSAT terminals communicate to each other using direct paths through the satellite, and thus VSAT-to-VSAT transmissions require only one satellite hop. In the star topology, all VSAT communications go through a hub. VSAT A transmits to VSAT B via an "inbound link" to the hub, where it is retransmitted on an "outbound link" to VSAT B. VSAT-to-VSAT communications thus involve two satellite hops in the star configuration. If there is little VSAT-to-VSAT communication, the star topology is particularly effective; for example, if a hub is co-located with a corporate headquarters and nearly all VSAT communications are to and from the headquarters.

Transmit and receive data rates for VSAT sites are limited by the antenna size and the capability of the transmit amplifier. In transponder-based star networks, the hub antenna size and transmit amplifier power can usually be made large enough that the link between the VSAT and the satellite dominates performance. Consequently, higher transmit and receive data rates are generally available in star networks than in mesh networks where both the uplink and downlink are limited by VSAT performance. Data rates vary with terminal size, but typical VSATs have transmit information rates between 64 and 512 kbps and receive information rates between 64 and 6000 kbps.

Figure 2. VSAT Network Topologies



The VSAT sites in a network must share the total satellite bandwidth and power resources available to it. The total resources may be divided by frequency, time, spread-spectrum multiple access codes, or combinations thereof, and the segments assigned to the multiple sites. Such assignments may be defined permanently (fixed assignment), or the assignments may be dynamic based on the traffic (demand assignment). Figure 3 compares fixed assignment and demand assignment.

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Figure 3. Fixed Assignment Versus Demand Assignment

Access	Advantages	Disadvantages
Fixed Assignment	• Simple Implementation • Lower delay in connection setup • No blockage if VSAT site stays within its allocated capacity	• Inefficient bandwidth utilization • Fewer terminals can be supported by network with a given bandwidth
Demand Assignment	• Active terminals may take advantage of unused bandwidth • Less bandwidth required for network, particularly for bursty traffic • Network with a given bandwidth can support more terminals	• More complex network protocols • Longer connection setup delay • Non-zero blockage probability

3. VSAT NETWORK ANALYSIS

The following analysis compares the costs of operating a VSAT network using transponder versus processing payload implementations. The analysis uses a specific real-life example network, whose key network parameters are described. This is followed by a detailed analysis of the costs for transponder and processing payload implementations. Although the reference network serves as the analysis baseline, its sensitivity to key network parameters such as capacity and connectivity is also explored. In evaluating the processing payload case, TRW's Gen*Star architecture described in [1] is used as the reference payload.

3.1 REFERENCE NETWORK PARAMETERS

The reference network was based on a published RFP [2] for a VSAT network to service Barclay's Bank in Europe. This example was chosen because it provided a concise traffic model, summary cost data was available, and it was an application representative of typical VSAT networks. In addition, since it was an application well suited to a transponder-based star network, it provided a challenge to processing payload implementations.

Servicing approximately 230 geographically distributed sites in Europe, the network is used for a proprietary banking application in which local offices retrieve customer account information from a central data center. Key network requirements are summarized in Figure 4.

Figure 4. Reference Network Requirements

Network Parameter	Requirement
Application	Banking
Number of VSAT sites	230
Contract duration	5 years
Daily transactions	306,000 both inbound and outbound
Daily throughput	44 Mbytes inbound and 73 Mbytes outbound
Peak transaction rate	110,000 transactions per hour
Peak throughput	16 Mbytes/hour inbound and 26 Mbytes/hour outbound
Average transaction size	150 bytes inbound and 250 bytes outbound
Guaranteed network response time	2.5 seconds

3.1.1 Network Throughput Analysis

Several of the key costs in a VSAT network are a function of the throughput required to support the network. The throughput must be sufficient to support the network under peak traffic conditions. Here the decision to employ a fixed assignment or demand assignment access scheme can have an extremely large impact on overall network cost. In a fixed assignment scheme the total throughput required is the number of sites times the peak throughput required per site. Clearly, if the ratio of peak-to-average throughput required by a terminal is high, provisioning the network to accommodate all terminals simultaneously in their peak condition is wasteful and expensive. For our reference network, the traffic is quite bursty and the delay constraints are not too demanding. Thus it is a natural choice for a demand assignment scheme.

An analysis to determine the throughput requirements of the reference network with a demand assignment scheme was performed using the traffic parameters in Figure 4. The key performance metric was the guaranteed (99.5% of the time) maximum response time of 2.5 sec. The response time begins when the remote VSAT wants to send a request and ends when the hub's reply reaches the remote, but does not include time that the hub spends processing the remote's request and preparing its reply. Since the throughput analysis is dependent on the functional operation of the network, the following operational concept was assumed:

1. A remote VSAT with a transaction to be processed requests bandwidth by transmitting a bandwidth request message
2. The demand-assigned-multiple-access (DAMA) process receives the remote's request for bandwidth and prepares a bandwidth assignment message that is sent to the remote. Assignments are made in first-come first-served order for all requests made in this step and in step 7.
3. The remote receives the bandwidth assignment message, waits for the assigned bandwidth to become available, then sends the transaction request message to the hub
4. The hub receives and processes the transaction request and transmits a reply

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5. The remote receives the transaction reply (this is the end of the network response interval)
6. The remote requests bandwidth for its confirmation message
7. The DAMA process receives the request for bandwidth and prepares a bandwidth assignment message which is sent to the remote
8. The remote receives the bandwidth assignment, waits for the assignment to occur, then sends its confirmation message to the hub.

Using this model of the functional flow combined with the traffic model parameters described above, the required network throughput was computed. For a DAMA algorithm resident at the hub (or network operations center for the processing payload), the 2.5 second network response time was satisfied 99.5% of the time with a total network data rate of 260 kbps. This includes forward and return traffic as well as framing and signaling overhead. If the DAMA algorithm is resident on the satellite payload (available only in the processing payload option) the total network data rate is slightly lower at 255 kbps. Had a fixed assignment access scheme been used, 5 to 10 times more throughput would have been required to support the network.

Transponder Throughput Implications. For the transponder-based network, a fixed amount of transponder bandwidth is leased to support the required network throughput. The total network throughput can be translated to transmission bandwidth by applying modulation, forward error correction coding, and guard band assumptions. In typical transponder networks, these data rates are in the border region between BPSK and QPSK modulation. We optimistically assume QPSK is used. Including guard bands, spectral efficiency is assumed to be 1 bps/Hz. Rate ½ FEC coding is also typical for transponder-based VSAT networks. Therefore, the total bandwidth required for the transponder network is (260 kbps)x(2 code bits/info bit)/(1 bps/Hz) = 520 kHz.

Processing Payload Throughput Implications. For the processing payload network, required network throughput is not accommodated by leasing a fixed amount of transmission bandwidth. Some of the flexible ways in which processing payload throughput may be procured are discussed in Section 3.2.4.

3.2 COST ANALYSIS

VSAT network cost is the total of costs for terminal equipment and maintenance, network infrastructure (e.g., hubs and leased lines), satellite usage, and licenses. Commonly, the total is used to derive a cost-per-VSAT-site-per-month. In the following sections, the primary cost components are calculated for transponder and processing payload implementations of the reference network.

3.2.1 VSAT Terminal Costs

VSAT earth station costs represent a large portion of the overall network cost. Earth station costs include both the purchase of the equipment and substantial installation and maintenance costs. Terminal costs are also a function of the data rates and availability required for a given application. As discussed above, the data rates required for both transmit and receive information are about 150 kbps. Such rates can be supported with relatively small terminals.

Transponder Terminal Costs. Historically, equipment costs for transponder-based terminals that support these data rates have been approximately $10,000 per site [3]. In recent years, costs have been reduced to approximately $3500-$8000 [2]. Installation costs are about $1,000 per site and yearly maintenance costs are roughly 10% of the equipment cost. For the purpose of this analysis, we assume prices will continue to drop. We optimistically assume that by the time processing systems are available transponder-based VSAT equipment will cost approximately $3000.

Processing Payload Terminal Costs. Most of the proposed processing payload systems will support several classes of terminals. TRW's Gen*Star system accommodates three classes of terminals (see Figure 5). The class Z terminal exceeds the requirements reference network and provides substantial growth capability for increased capacity.

Figure 5. Gen*Star Terminal Classes

Parameter	Class Z Terminal	Class Y Terminal	Class X Terminal
Antenna diameter	< 100 cm	100 cm	180 cm
Uplink information rates	16 kbps to 1 Mbps	16 kbps to 5 Mbps	16 kbps to 25 Mbps
Downlink information rate	120 Mbps	120 Mbps	120 Mbps
Uplink access	FDM/TDMA	FDM/TDMA	FDM/TDMA
Downllink access	TDM	TDM	TDM

Target prices for the class Z terminals are considerably less than existing transponder terminals designed to support the same data rates. The primary reason for the lower cost is a different business paradigm. The processing payload systems are designed to support far greater numbers of interactive users. With this increased revenue-generating capacity, the satellite network operators are highly motivated to maintain as large of a user population as satellite capacity permits. Consequently, processing payload system developers have identified user terminal costs as a key issue. Given that all terminals for a processing payload system will share a common standard and a single satellite may be capable of supporting over one million users, the production quantities of processing payload terminals should be much greater than existing transponder-based terminal equipment. In addition, processing payload system developers have established strategic partnerships with terminal manufacturers and are actively pursuing aggressive price targets. The price target for class Z type terminals is approximately $1000. As with the transponder terminal, a $1000 per site installation fee is assumed as well as a 10% annual maintenance fee. Not only is this price substantially less than transponder-based equipment, but the processing payload terminal provides extensive data rate growth capability. A summary of terminal related costs for transponder and processing payload networks is provided in Figure 6.

Figure 6. Terminal Cost Summary

Terminal Cost Item	Transponder Network	Processing Payload Network
Terminal equipment	$3000/site	$1000/site
Installation	$1000/site	$1000/site
Maintenance (10% of equipment $)	$300/site/year x 5 years	$100/site/year x 5 years
Total per site (5 years)	$5,500	$2,500
Total for 230 sites	$1,265,000	$575,000

3.2.2 Infrastructure Costs

Since all VSAT communication in the reference network is to and from the central data center, a star network is the logical topology. With a star topology, the hub costs must be included in the overall network costs.

Transponder Infrastructure Costs. For the transponder-based implementation, the two basic hub options are: (1) a dedicated user-owned and operated hub, and (2) a shared leased hub. A dedicated hub gives the customer full control of the network. Furthermore, the hub can be co-located with the central data center, eliminating the need for leased terrestrial lines between the two. While the dedicated hub provides the highest degree of control and flexibility, it also requires the highest capital expenditure. A mini-hub with a 2-3 m antenna capable of supporting up to about 400 VSAT sites typically costs approximately $120,000 [3]. Larger hubs that service 1000 VSAT sites can cost over $1,000,000. In addition to the one-time purchase and installation, recurring operation and maintenance are estimated at approximately $380,000 per year.

Shared leased hubs offer a more attractive cost scenario, particularly for smaller networks. In [3] the yearly lease for a hub supporting 1.25 MHz to the network is approximately $48,000. Since lease costs scale fairly linearly with bandwidth, the 520 kHz of bandwidth needed by the reference network would cost approximately $20,000 per year. Although the costs are considerably lower than the dedicated hub, there are some disadvantages. Any future expansion of the network would require additional hub capacity to be available. Since the shared hub is not co-located with the central data center, a leased terrestrial line is needed to provide this connectivity. The RFP indicated such leased terrestrial lines would need to be at least 256 kbps. The exact cost of the leased line depends on the specific countries hosting the data center and the hub as well as the distance between the two. In [3], a leased line for a typical European system is estimated to cost $20,000 per year.

Processing Payload Infrastructure Costs. The inherent flexibility of processing payloads provides unique possibilities for a hub. In a transponder-based star network, the hub handles connection requests and overall resource management. In TRW's Gen*Star architecture, these functions are performed for the entire satellite network of users by a single Network Operations Center (NOC). The cost for such services is built into the satellite usage fees (to be discussed later). Therefore, this hub is simply a terminal capable of adequate data rates to service all of the remote sites. Such a terminal can easily be located at the central data center, thus eliminating the cost of leased terrestrial lines. Since the hub is basically a terminal without much of the required functionality of transponder-based hubs, operation and maintenance costs are more consistent with those of remote terminals. Furthermore, the required transmit and receive information rate for the hub in our reference network is only about 150 kbps. This is easily accommodated by a class Z Gen*Star terminal described above.

Figure 7 is a summary of infrastructure costs for transponder and processing payload implementations of the reference network.

Figure 7. Comparison of Infrastructure Costs

Parameter	Dedicated Hub Transponder Network	Shared Hub Transponder Network	Processing Payload Network
Hub Equipment	$120,000	N/A	$3,000 + $1,000
Hub Operation & Maintenance	$380,000 x 5 years	N/A	$300 x 5 years
Hub Lease	N/A	$20,000 x 5 years	N/A
Terrestrial Leased Line	N/A	$20,000 x 5 years	N/A
Total (5 years)	$2,020,000	$200,000	$5,500

3.2.3 License Costs

License fees can also be a non-trivial component to the total VSAT network cost. Fees vary substantially between countries, ranging from about $10 to $2000 per site per year. Since these fees are independent of whether the network is transponder-based or processing payload-based, they are not a differentiator. The RFP summary [2] recommended an average monthly fee of $40 per site as a guideline.

3.2.4 Satellite Usage Costs

The last component of total VSAT network costs is satellite usage.

Transponder Satellite Usage Costs. For typical transponder networks, a fixed amount of bandwidth is leased to support the entire network. Leased transponder rates are a function of location and the quantity of bandwidth to be leased. Wholesale rates for 36 MHz Ku-band transponders range from $1.7M to $2.3M per year, with the cheapest rates in Asia and the highest in Europe. Rates per unit of bandwidth increase if only a fraction the transponder is required. A rate of approximately $190k/MHz/year is used as a typical fractional transponder lease rate [3]. At this rate, the 520 kHz of bandwidth required for the reference network would cost approximately $100K per year.

Processing Payload Satellite Usage Costs. For processing payload networks, there are a number of scenarios available for satellite usage fees. Three examples are:

- A fixed amount of bandwidth is partitioned off and managed exclusively by the VSAT network (similar to transponder network)
- The network is billed only for bandwidth used (similar to ATM switched virtual circuit networks)
- A flat monthly rate per terminal is charged for unlimited use at set peak rates (similar to ADSL networks)

Each of these scenarios is a viable approach with unique advantages; the best choice depends on the needs of the network. The second and third approaches are more cost-effective as they take greater advantage of the unique properties of the processing payload. Some of the key features of processing payloads that promote lower usage fees are:

- Multi-beam frequency re-use increases satellite raw capacity
- Statistical multiplexing allows traffic with varying degrees of burstiness to be handled more efficiently, increasing the effective satellite throughput
- On-board processing allows empty uplink time slots to be discarded, increasing the efficiency of downlink transmission
- Ability to dynamically reallocate unused bandwidth allows for lower cost to each customer
- Uplink and downlink bandwidth can be provisioned asymmetrically to take advantage of traffic statistics
- On-board demodulation improves link performance and yields higher bandwidth efficiency

In [1], a representative Gen*Star multi-beam processing payload was described with approximately 7 Gbps of raw capacity. We will use this as our reference processing payload capacity. Referring to our network throughput analysis in Section 3.1.1, the 260 kbps of required network throughput represents 0.0037% of the satellite's total 7 Gbps of raw capacity. In comparison, the transponder implementation required 520 kHz out of the satellite's total 1 GHz (typical dual polarization license bandwidth) of billable resources (i.e. 0.052%). The ratio of required-to-available satellite resources is thus a factor of 14 higher for the transponder implementation. In actuality this factor is probably much higher, since the resources required for the processing payload can easily be resold during periods of the day when the network is not fully utilizing them. Processing payloads do carry a higher price tag than transponder payloads. Conservatively, the space segment and corresponding ground support equipment costs for a processing payload are roughly twice those of a transponder. This cost includes additional functionality of the network operations center which provides resource management and access control for the entire satellite. Combining the utilization factor and cost factors, it is reasonable that satellite usage costs for the processing payload will be approximately 1/7 those of the transponder.

3.2.5 Transponder Versus Processing Payload Cost Totals

Figure 8 is a summary of total costs for transponder and processing payload implementations of the reference VSAT network.

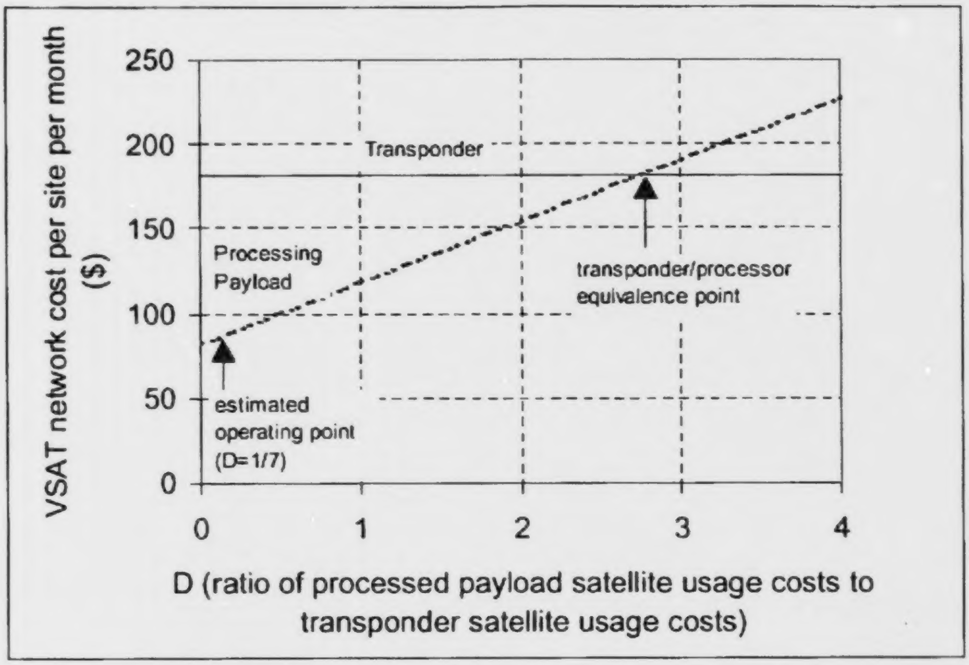
As a validity check, the transponder-based costs computed here were compared to the response bids from the reference network RFP [2]. The bids ranged from $3,000,000 to $7,500,000 (average was $4,900,000) and did not include license fees or terrestrial leased line fees, which account for $652,000 of the total in Figure 8. Therefore, the transponder network values computed here are lower than the actual bids that were submitted primarily due to our aggressive, forward-looking assumption on transponder-based terminal costs. Even with these very optimistic assumptions for transponder-based networks, the processed payload implementation still resulted in a cost reduction of over 50%.

Figure 8. Reference Network Cost Totals

Cost Category	Transponder Network Cost ($)	Processing Payload Network Cost ($)
Terminal Equipment & Maintenance	1,265,000	575,000
Infrastructure Costs (5 years)	200,000	5,500
License (5 years)	552,000	552,000
Satellite Usage (5 years)	500,000	500,000 x 1/7
Total (5 years)	2,517,000	1,204,000
Total per site per month (230 sites)	182	87

The most uncertain cost in the analysis is the satellite usage cost for the processing payload implementation. Figure 9 illustrates the sensitivity of this parameter by plotting total processing payload costs as a function of the ratio of (satellite usage costs for the processing payload)/(satellite usage costs for a transponder). This ratio is referred to as "D." Even though D was estimated to be approximately 1/7, the processing payload network implementation actually results in lower overall costs as long as D is less than approximately 2.75. This demonstrates that there is a wide "win-win" service pricing range where satellite operators and middle level network service providers can realize greater revenues while still providing a lower cost solution to users than existing transponder networks.

Figure 9. Network Costs Versus D



3.2.6 Transponder Versus Processing Payload Cost Sensitivities

The traffic model assumptions for the reference network were very favorable to a transponder-based implementation. Even with these assumptions, the processing payload implementation was considerably less expensive than the transponder implementation. This section explores the impact of changing some of these assumptions.

First, consider the possibility that the type of network traffic has changed over time and now the majority of traffic is VSAT-to-VSAT instead of VSAT-to-data center. Since all communications must still go through the hub in the transponder implementation the network bandwidth required by the satellite and the hub will increase significantly. Depending on the amount of VSAT-to-VSAT traffic, this could mean as much as 100% increase in required bandwidth. For this example, we will assume a 75% increase in bandwidth for both the satellite and the hub. Hub costs thus increase from $100,000 to $175,000 and satellite usage costs increase from $500,000 to $875,000. Conversely, TRW's Gen*Star processing payload implementation requires *no* additional bandwidth to provide VSAT-to-VSAT traffic.

In addition, let us revisit the assumption that D = 1/7 (satellite usage costs for processing payloads are 1/7 satellite usage costs for transponders). This was based on a percentage of satellite resource utilization under peak conditions. One of the major advantages of the processing payload is its ability to dynamically reallocate bandwidth based on instantaneous demand. If the resource demand of our reference network drops from its peak throughout the day, those resources can be resold to other networks. Therefore, the network can be billed on its statistical usage over the day rather than its peak needs. It is quite likely that D could go from 1/7 to 1/14 based on this capability. Further, since the processing payload implementation did not require additional bandwidth to provide VSAT-to-VSAT traffic, this factor should be applied to the original transponder bandwidth costs prior to the increase for VSAT-to-VSAT traffic.

Using these updated assumptions, Figure 10 shows that total network costs for the processing payload implementation are less than 40% of the transponder implementation.

Figure 10. Transponder Versus Processing Payload Network Costs (Example 2)

Cost Category	Transponder Network Cost ($)	Processing Payload Network Cost ($)
Terminal Equipment & Maintenance	1,265,000	575,000
Infrastructure Costs (5 years)	275,000	5,500
License (5 years)	552,000	552,000
Satellite Usage (5 years)	875,000	500,000 x 1/14
Total (5 years)	2,967,000	1,168,000
Total per site per month (230 sites)	215	85

4. CONCLUSIONS

Processing payload systems are in development now and will soon be part of the satellite communications landscape. Using very conservative assumptions and an example that did not take full advantage of processing capabilities, the analysis provided in this paper shows that processing payload networks can revolutionize the VSAT market. VSAT service providers who recognize the tremendous potential of these systems will be able to offer a dramatically lower-priced solution to their customers while realizing even greater profits than were possible with transponder based networks. In addition, processing payloads easily adapt to changing traffic needs of the network. The ability to provide full mesh connectivity, dynamic resource allocation, and statistical multiplexing of diverse traffic results in lower costs for existing VSAT networks and an easy migration path for these networks to expand their capacity, connectivity, and range of applications.

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Back to top of page **Back to the sessions page**

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Back to proceeding page   Back to the sessions page

☑ **Policy / Regulatory**

Monday, 15 January 2001
1100–1230

M.1.5 Interconnection Issues

Location: Tapa III

Chair: GREG DAFFNER, Chief Strategic Officer, Q-east Broadband, *USA*

M.1.5.1 Interconnect in the Asia Pacific–Millennial Trends (ABSTRACT)

JIM HOLMES, Principal Consultant, Ovum Pty Ltd, *Australia*

M.1.5.2 Does Cost-Oriented Pricing Mean Cost Standardization?: WTO Agreement and Long-run Incremental Cost (ABSTRACT)

MYUNGJA YANG, Researcher, Korea Telecom, and SOOCHEON KWEON, ETRI, *Republic of Korea*

INTERCONNECT IN THE ASIA PACIFIC - MILLENIAL TRENDS

Jim Holmes

Abstract

www.ovum.com

Interconnection - what is it?

Interconnection is the interworking of networks so that services connected to one network may call and be called by services connected to another. Interconnection, by other names, occurred traditionally in the international telecommunications arena, when national operators passed traffic between themselves, and terminated traffic addressed to services connected to their own networks. Interconnection as such is therefore not a new concept.

Why interconnect is important

In the world of national telecommunications monopolies the importance of interconnection was limited to ensuring that international traffic was terminated, and that limited private network operations that might be permitted had suitable operating interface arrangements with the public network.

The current importance of interconnection is dramatically different. In a liberalised, multi-operator environment, interconnection becomes critical. Without the ability to guarantee that its service subscribers can call and be called by all existing and future subscribers in the country, new entrants would attract no customers. Competition would be stillborn under these conditions.

Without suitable, workable arrangements for effective interconnection, network service competition cannot be sustained.

Sustainable interconnection

Without a suitable pro-competitive regulatory environment interconnection is not feasible or sustainable. This is only to say, in another way, that without a suitable regulatory framework, telecommunications competition will not be sustainable.

What therefore are the minimum conditions for sustainable and effective interconnection?

There have been two key influences shaping the answers to this question within national environments in the Asia Pacific, namely the WTO (World Trade Organisation) and APEC (Asia Pacific Economic Cooperation organisation).

In February, 1997, within the WTO negotiation framework, 68 countries concluded the Basic Telecommunications Agreement (BTA). The Agreement provides for the interconnection of foreign service suppliers with the PSTN in a timely manner, under non-discriminatory terms and conditions, at any technically feasible point, and at charges that are cost-oriented, transparent, reasonable, and unbundled to the extent that interconnecting parties will not be required to pay for network service elements, components and facilities that they do not require. The Agreement also requires public availability of the procedures for interconnection negotiations, and of the procedures applicable to major suppliers. Transparency considerations require that major suppliers will make available either its interconnection agreements or a reference interconnection offer. Dispute settlement procedures are also required based on the determination of independent arbitral bodies. These, therefore, are the minimum conditions for an effective interconnection framework as far as the framers of the Agreement is concerned.

The impact of the Agreement, supported by major trading nations in the region, such as the United States, cannot be under-estimated. The terms establish an important template for the development or re-alignment of national policies on interconnection.

The second important influence within our region has been the work of the APEC Telecommunications Group, (APEC Tel). In 1997 APEC Tel retained Ovum to survey interconnection arrangements in the member economies of APEC and to comment on emerging trends. At that stage the development of liberalisation in the region, and of the scope and depth of interconnection arrangements, were extremely diverse, ranging from the bilateral arrangements of carriers to intrusive national regulatory agency activity for the setting of terms and conditions. Carrier rights of interconnection were established clearly in most, but not all, member economies.

The APEC Ministerial Meeting in Singapore in June, 1998, adopted an important statement on interconnection as part of the Singapore Ministerial Declaration from that meeting (Paragraph 37), namely the recognition "that it is crucial to establish fair and transparent interconnection and access arrangements to support competitive service provision". The Ministers endorsed APEC Tel's efforts to develop interconnection guidelines (consistent with the WTO Agreement principles) and the creation of a flexible, non-prescriptive framework containing necessary principles to formulate interconnection arrangements to promote fair and effective competition in the market. The Ministers endorsed action to identify best practices for interconnection arrangements, including price benchmarks and time frames for negotiation.

The Ministers have therefore endorsed the WTO Agreement principles, but have required some degree of flexibility to enable interconnection to be effective in the different and various environments of APEC member economies.

Traditional interconnection emphases

The traditional emphasis of policy makers and regulators has been to establish frameworks or conditions for the interconnection of narrowband (telephony) services connected to the PSTN (Public Switched Telephone Network). There were a number of important reasons for this:

- Market power of incumbent carriers was associated with fixed network access to customers at the local network level.
- The mass of customers connected to telecommunications networks were connected via narrowband telephony access lines. Few business and other customers had broadband access in the mid-1990s or before.
- New services such as cellular mobile were not the subject of long-standing monopoly provision, and in most countries digital mobile services were being introduced on a competitive basis. Such services needed to have interconnection with fixed networks, but the high initial prices of mobile service tended to ensure that commercial sharing of revenues was readily achieved. Interconnection was an issue, but not one of great immediacy.
- Carrier networks were essentially circuit-switched and designed for voice. The issues associated with mass take up and use of the Internet did not commence until 1996, and the move to IP based next generation network design did not commence until at least 1997 in most countries. The issues of interconnection in a

broadband environment were potential and not immediate in the thinking of most regulators and industry participants.

Emerging trends

Within the Asia Pacific region there has been movement towards the interconnection environment envisaged in the WTO Agreement, but that movement has been almost entirely in terms of narrowband fixed telephony interconnection. The movement has not been consistent across the economies in the Region.

The basis for interconnection charge determination, for example, varies greatly from commercial negotiation supported by regulatory arbitration in Australia, to charge setting by the regulator in the United States.

The basis on which new entrants might access terms and conditions for interconnect also varies greatly. In countries where the rates and conditions are set by the regulator, the issue virtually does not arise. In countries where reference offers are required or where agreements are made public, such as New Zealand, transparency is less acute. In Australia, where an undertaking or reference offer is voluntary, access to information across the industry and to guidelines on current trends in charge negotiation is still in the hands of major incumbent operators. There is an information asymmetry which gives incumbents and others who have negotiated a large number of 'serious' interconnect agreements a decided advantage.

Notwithstanding the above, the emerging trend noticeable through Ovum's work on interconnection in the region (and globally) has the following features:

- Commitment to a cost-related charging structure, with long run incremental cost standards emerging as the most preferred.
- Commitment to the principle that interconnection should not require new entrants to pay for the inefficiencies of incumbent operators and that the rates should provide incentives for efficiency. Interconnection rates are therefore typically based on the costs that would be incurred by an efficient operator.
- Growing interest in benchmarking to ensure that national interconnection rates and conditions are aligned to world's best and better practices.
- Limitation on the timescales available for negotiation between carriers before one or both may seek the intervention of the regulator or arbitration. Governments and regulators are becoming less prepared to allow incumbents to delay interconnection outcomes and to retard the entry of new carriers.

In addition, the regulators and participants in most countries are commencing to recognise the important issues associated with mobile and broadband interconnect, and to take initial action in recognition that the telecommunications world will be changed forever by developments in these areas. These changes will occur over a relatively short period, and be effectively in situ by 2007.

Mobile interconnection

Mobile service penetration is proceeding at a high rate. Typical penetration rates in the developed economies of the region are in or above 35 per 100 population. In Hong Kong the penetration is 55 per 100 population, and exceeds the fixed service penetration level (53 per 100).

Mobile penetration is driven by:

- price and feature competition
- technology
- increasing convenience
- increased coverage
- lifestyle changes.

While mobile service prices were relatively high, revenue-sharing arrangements for interconnection were convenient and easy to negotiate. Increased competition, contracting margins and lower base annual revenues per user (ARPU) have changed the cosy basis for such arrangements.

Regional regulators have tended to require fixed network operators to set the same cost-based interconnect prices for terminating calls from mobile networks as they charge for calls from other fixed networks. This approach is non-contentious and generally supported by mobile operators.

Increasingly, however, regulators are requiring mobile operators to charge for terminating calls on their network at cost-based prices. This is more controversial, and, if implemented would reduce fixed-to-mobile and mobile-to-mobile terminating charges by over 75% in many countries.

Our work suggests that the **cost** of terminating a call on a mobile network is around 5-6 times that of fixed network terminations, whereas the rates charged are typically 10-15 times. These figures are averaged and offered as 'rules of thumb' for current practice. In Australia for example, the regulator (ACCC) has recently suggested a fixed termination rate of 1.5 (A) cents per minute (averaged). Some current commercial agreements exceed that by 10 times for mobile terminating access.

A range of indicative mobile terminating rates is illustrated in Table 1 below:

Table 1: Examples of Fixed to Mobile Interconnect Rates in the Region

Country	Net fixed terminating access charge	Party responsible for call charges	Mobile terminating access charge	Mobile : Fixed charges
Australia	0.8	Calling party	13.2	16.7 times
Hong Kong	0.4	Called Party	1.0	2.1 times
Japan	4.3	Calling party	43.5	10.2 times
New Zealand	1.0	Calling party	14.5	14.0 times

Source: Ovum, 2000 (Charges in US cents per minute)

Note that the Hong Kong example is not comparable with the others because a called party pays arrangement is still in place in Hong Kong

Regulators are starting to recognise that fixed to mobile retail prices are being kept artificially high by excessive interconnect charges, and are reviewing the situation. Competition alone (usually very strong in urban mobile markets) is insufficient to impact what is a local access bottleneck. This situation is not affected by the fact that a mobile operator may be generally non-dominant in the market. It still has substantial power in relation to access to its own customers. These customers are not directly affected, and may be neither aware nor concerned, by the costs imposed on callers to them.

Broadband interconnection

All new entrant and incumbent carriers are now implementing plans for operating Internet Protocol (IP) based or next generation networks. If they do not move in this direction they will soon be out of business.

IP networks are based on Internet Protocol and carry all traffic as packets on an IP backbone. The platforms are based on open technology with separation of switching and transport functions from services and applications. Most importantly they are integrated. Network operators need no longer operate separate voice and data networks, or overlay networks, or maintain separate narrowband and broadband platforms. The move to IP next generation networks is being driven by:

- service competition, and the need to design and deliver customised services of a kind that are only cost-effective in a ubiquitous IP environment
- the data wave, resulting from mass take up and use of the Internet in business and by residential customers
- cost savings resulting from massively reduced unit costs of traffic conveyance and management. Suppliers such as Lucent, Ericsson and Nortel report typical 50-80% cost improvement for new networks, and operators are claiming around 30% cost improvements for incumbent upgrades.

Regulation of broadband is yet to converge. Regulators have yet to come to grips with the essential requirements of competition in a broadband environment and how that might relate to existing predominantly narrowband regulation. There has been some window dressing with new agencies in some countries. They have been renamed to provide a convergent flavour - but the reality (the black letter of policy and law) remains un-converged.

Regulatory paradigms are hard to shift. Telecommunications regulators have developed their approaches heavily based on narrowband telephony models. This applies also to their interconnect models.

As we know, legal structures become capitalised, and for that reason contain their own inertia. It is not just the regulators who need to reconsider the fundamentals of interconnection in the new broadband environment. It is also the industry. Indeed, many ISPs are keen to exploit the intersection of narrowband interconnection pricing with always-on broadband and Internet access arrangements. They need local interconnection that reflects the retail structure of free or untimed local calls.

Internet access and IP networking brings into stark relief the fact that circuit switched is based on

- channels that are permanently connected
- retail charges based on distance and minutes;

whereas IP is packet based, involving

- no permanent connections
- charges based on data volumes transferred.

The inevitable conclusion is that a new model for interconnection is needed.

There are a number of fundamental choices in how this might be achieved, including

- Peering agreements, as in the case of the Internet. (Note however that these arrangements are now heavily in dispute, particularly following the apparently successful action of the major Internet backbone operators in 1997 to convert their erstwhile peers into customers.)
- Revenue sharing (which does not necessarily promote the overall public interest in transparent and cost-based interconnection charging).
- Flat rate access charges (which may not appropriately reflect direct transaction-driven costs, except on a very averaged basis).
- Volume based charges, (as is typically the case with current narrowband interconnection).

The purpose of this paper is to raise the issues confronting regulators, industry participants and users, rather than to suggest the desirability of specific interconnection approaches.

It is important to note that some regulators, such as OFTA and the ACCC, have commenced the process of discussion of the wider issues, and also whether transition to a new order will require modification of current narrowband arrangements. For example, what guarantees are appropriate to be given to the incumbent fixed operator regarding the recovery of the costs of newly ordered circuit switches for interconnect gateway exchanges from interconnect revenues? This is especially important, given the asset lives used for interconnect purposes average 10-15 years, and given that the move to broadband access and voice over IP is likely to be substantially completed by 2007. The issues, therefore, go beyond determination of the most suitable arrangements for a broadband future. They include the transition process, and how that might affect a narrowband model that many in the industry consider to be a final result requiring no further adjustment.

A major concern at this stage is that there is no obvious leadership in the management of the discussion and the debate on broadband interconnect issues. Regulators are essentially concerned about the implementation of current policies. Industry is divided by conflicting agendas. Governments are hampered by the fact that Internet related issues are global, and solutions typically transcend national borders. It is not clear how issues associated with IP and broadband interconnect will be raised and resolved. There is no clear template of the kind offered in the 1990s for narrowband interconnect by the WTO or APEC Tel.

Conclusions

Our major conclusions about the trends in interconnection in the Asia Pacific region at the beginning of the new millennium are:

- There are emerging commonalities and consistencies in the national implementation of narrowband interconnection on the telephony model.
- Emerging consensus in this area has been materially assisted by the WTO Agreement and the activities of regional forums such as APEC.
- Consistency and commonality should not be confused with uniformity. There still exist substantial differences within the region on matters such as the precise pricing principles to apply to interconnect rates, and the role of the industry participants and regulators (price setters or arbitrators). Transparency measures also vary widely.
- Most countries review their interconnection frameworks from time to time.
- In the mobile interconnect area there are substantial moves (but in some regional countries only) to examine whether mobile service competition is sufficient to ensure efficient and public interest interconnection outcomes.
- Much more attention can be expected to be given to mobile interconnection in the next 5 years.
- In the meantime, mobile terminating access rates remain well above the levels that incremental long term cost (LRIC) standards would suggest.
- Concern about the implications of the broadband and IP revolution for interconnect is increasing. It is not at all clear how the issues will be raised, discussed and resolved in most countries in the region. Some, such as Hong Kong, have initiated preliminary consideration.
- Leadership is wanting in the identification and resolution of broadband interconnection issues and the development of sustainable models.
- Transition issues are especially difficult for broadband interconnect, given the obligations that are usually placed on all carriers to continue to invest in technologies that will ensure continued narrow band interconnection on the traditional model.
- We have only a small time window in which to address and resolve the related issues. Realistically that window is 2 years only - or even less.

Back to top of page **Back to the sessions page**

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Go to proceeding page **Back to the sessions page**

Does Cost-oriented Pricing Mean Cost Standardization? : WTO Agreement and Long-run Incremental Cost

Myungja Yang and **Soocheon Kweon**

Abstract

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1. Introduction

OECD, APEC and other economic organizations influenced by the WTO Agreement require member countries to set "cost-oriented price" for interconnection, national or international. However, it is very difficult to define what real cost is in a situation where hundreds of costing methodologies exist worldwide. On one end of spectrum, there is historical stand-alone costs and on the other end, there is forward-looking LRIC. International opinion leaders prefer forward-looking LRIC to historical costs. They drive other countries to adopt the preferred methodology. Due to the limitations of knowledge, however, less developed countries usually import their costing methodology from the leading countries. As a result, standardization of cost level itself as well as costing methodology is spreading out. Benchmark system stimulates this movement.

Issues on mark-up level, technical alternatives and geographic/economic differences are raised from the side of incumbent carriers. However, regulatory powers rather than theoretical backups settle these debates. This paper investigates the pattern of standardization in costing methodologies and find out the influences of the WTO Agreement. The future impacts on the Rate of Return(ROR), one big untouched issue, are also considered.

This paper is organized as follows: The overall background and introduction is mentioned in Section I. Historical backgrounds and theoretical issues on interconnection costing methodologies are briefly overviewed in Section II. Section III explores the critical issues commonly raised by the LRIC undertaking countries. Section IV summarizes the findings and lessons. Section V concludes the paper.

2. Historical Backgrounds and Theoretical Issues

Historical Backgrounds

Telecommunications industry has long been in monopoly. However, new entrance of competitors is transforming the market into duopoly or oligopoly. Additional allowance of resale market makes some services fully competitive. This trend diminishes the ex-monopolist's market share and pushes them to explore the overseas markets. However, the interconnection rates are criticized by the global investors as one of the biggest obstacles in entering the market. In order to lower the interconnection rate, they drive the local governments to adopt LRIC through international trade organizations.

Role of WTO

The WTO initiates discussions on the cost-based pricing and finally declared the principle on the reference paper. It does not specify LRIC as a costing methodology. However, most international conferences and meetings are referring to the LRIC as the best costing methodology. The representatives and negotiators from the WTO, OECD and other trade organizations explicitly and implicitly pressure their counterparts to adopt the LRIC. The bigger and the more profitable the telecommunications market is, the stronger the pressure is on.

LRIC vs. FDC

Regarding the fully distributed cost(FDC), it has been told that the methodology has a big embedded defect: all cost incurred by the carrier, whether it is efficient or not, is allowed to recover. Carrier's inefficiency and ambiguity is, therefore, shared by the whole industry using the incumbent's facility. However, implementation procedures in this model are relatively clear because historical accounting data are used. On the other hand, the LRIC is hard to be implemented. Many assumptions and conditions are involved during the implementation. As the model is theoretically made, adaptation procedures are needed in the real world. However, the purposes and the procedures of LRIC are idealistic and powerful to debates. These characteristics of LRIC help the developed countries to easily attack the costing methodologies used in other countries. They persuade other countries to adopt the best methodology, LRIC, and then push them to lower the interconnection rate to the level of it.

Characteristics of LRIC

In LRIC methodology, cost is estimated over the long run. Long-term projection in this model is necessary to avoid theoretical problems such as capacity volatility and true profitability of entry. With short run, consistent cost result is hard to earn because inventories fluctuate and profitability is obscure. Secondly, forward-looking cost mirrors today's investment choices of operators, both for incumbents and new entrants. Incumbent operators need to modernize existing networks and new entrants have to decide whether to build a new network or to buy. Thirdly, operator's efficiency is measured based on its actual networks, but assumed best-practice of operation. Fourthly, mark-ups on LRIC enable the operator to recover its joint and common costs. As a result, the model prevents over-investment in old PSTN while stimulating investment in new services. Existing facilities are fully utilized and new investment is economically encouraged where the economic welfare is maximized.

3. Major Issues on the Undertaking of Cost-based Pricing

Pursuant to the WTO Agreement, many countries are currently trying to adopt LRIC, partly voluntarily and partly compulsively. The U.S. trade officials have long complained that other countries' telecommunications sector was encumbered by outdated and anti-competitive regulations. Through 1998 to 1999, not a few countries agreed to introduce market-based prices for telecommunications networks dominated by one carrier. As LRIC was not explicitly expressed, the market-based cost could not be necessarily LRIC. However it was interpreted as LRIC. If the performance is not felt satisfactory, subsequent bilateral negotiations are usually initiated. As a result, the Telecommunications Act in those countries is often revised to declare introduction of LRIC.

The pattern of decision-making process in the signatories has been changed since the WTO Agreement. Every step of execution is closely observed and directed by overseas governments and business sectors. For example, OECD inspectors are frequently dispatched to the member countries and they are required to report the implementation procedures of WTO agreement. In more specific, as shown in Japan, inputs on LRIC are usually commented by trade officials on be half of their industries. Major issues raised on LRIC modeling are as follows;

Topology

LRIC is characterized as assuming network configuration most efficient and most economic. However, the "scorched node" approach, currently most applicable, is troubled with several embedded problems. Even though it assumes that the wire-center is located at the existing place, so many factors need to be decided. The size of grid and the number of samples impact on the precision of the result. Customer locating and clustering methodology also greatly influence on the result. Regarding the topology, switching technology also greatly impacts on network configuration. The choice of switch with less capacity requires it to deploy many more end-offices and vice versa. Not to speak of the inputs, the basic data such as geo-code and census are not well established as well in the developing countries. Therefore, network design itself could be controversial.

Technology

LRIC assumes the most current and forward-looking technology. However, the point of view on the current and forward-looking technology is different, person to person and country to country. For example, some people assume SDH as the only forward-looking transmission technology but others PDH. Even though traffic concentration is considered on this issue, question is left whether non-PSTN demand should be included in the demand on transmission routes if the replacement is driven by demand for new services. Controversies are also going on the local loop. Everybody's thought is different in prospecting the major technology in future local loop: copper, fiber, WLL, or combination. In case of combination, once again, people begin to struggle with the optimal proportion.

Deployment of Lines

LRIC also assumes the ratio of lines buried versus deployed aerially. Even though the model tries to reflect the best practices of an efficient operator, the ratio is influenced by the country's historical choices: whether to bury lines or to place lines on the poles. In some cases, inefficient investment on the burial is derived from the rate-of-return regulation. Under this regulation, carriers have an incentive to expand unnecessary civil construction because the cost is allowed to recover. Sometimes, however, the deployment is influenced by the uneconomic factors such as environmental protection and public works. The burdens are different from country to country. Therefore, decisions have to be made on what the inefficient investment is and what the inevitable investment is.

Utilization(Spare Capacity)

LRIC assumes facilities being most economically utilized. However, spare capacity is necessary because it reduces total costs by minimizing frequencies of construction and by attaining discount on the machines and materials. The total costs might increase if a company executes civil works every time new demand occurs and buys small amount of materials in each time. Spare capacity also improves service quality. Companies need spare capacity for the case of breakdown, abrupt demand increase and projection-error. However, the opinions on the optimal level of spare capacity are all different and it is hard to prove. In addition, the amount of spare capacity changes depending on the country's stage of development and level of technical expertise.

Cost Assignment

Another decision-making process is necessary to divide the traffic-sensitive cost from the non-traffic sensitive cost. The characteristics of costs are determined based on whether additional investment is incurred or not when traffic is increased. Decisions on this matter are important because the impacts on the per-minute termination charges are significant. The items that could be exampled, are remote terminals, line cards and vertical features of switch. In most countries, the current costing methodology treats all switch costs as traffic sensitive. However, in the U.S. and the U.K., some proportion of the cost of a switch is attributed to non-traffic sensitive costs.

Depreciation Rates

LRIC assumes economic lives of equipment. Tax lives are not usually used in this model because they are influenced by the budget purpose, not by the economic usage. In common cases, tax lives are shorter than economic lives, resulting in higher interconnection rates. Therefore, the countries using tax lives to estimate interconnection rates are recommended to change it to the years of other countries. However, economic lives are influenced by the government's and the carrier's supply policy, weather and geological characteristics, technological developments, service cycles and so on. Economic lives tend to be shorter if "family suppliers" with sub-standard are preferred, topology is changeable and weather is more wet, the current technology is on replacement, and service cycle is short. Therefore, countries have to analyze their situation before imitating the economic lives of other countries.

Maintenance Cost Ratios

In LRIC, maintenance cost is frequently estimated based on the ratio to the investment costs. Even though historic accounting data can be used, there are few countries which have well-established book records in developing countries. Therefore, the ratio is usually benchmarked from the advanced countries. However, such a simple reference is very risky because the each country has different definitions on the investment costs and because the pattern of maintenance could be different. For example, the investment denominator of a country's model may include all assets, including support assets like accommodation but another country's model may include part of these items. The maintenance cost is also influenced by the automation in maintenance system. A country which has completed automation has a lower level of the maintenance cost ratio to the investment cost than that of other countries which mostly depend on the manual dispatch.

Volume

In estimating interconnection rate, traffic volume has significant impacts on its level no matter what model is employed, historic or forward looking. However, the future expectation needs more assumptions and more subjectivity is involved in it. Discussions are mostly focused on what year's traffic data are used in estimating per minute charge. In case of Japan, the LRIC model is criticized as its interconnection rate in 1999 is estimated based on 1997 volume reports rather than using 1998 or 1999 data. Commentators say that the volumes will have grown since 1997 and so this will lead to many of the unit costs being overestimated. They also argue that all the demand from local and long distance calls and from all other services, such as mobile and free phone is to be included.

Fair Rate of Return(ROR)

A unitary and overall ROR for the regulated companies has been generally estimated by the weighted average cost of capital(WACC) methodology. The calculation requires a data on the cost of equity, the cost of debt, and the capital structure of the company. WACC is the sum of cost of equity and cost of debt, each weighted by its proportion in the capital structure of the company. To determine these components, companies have to undertake a complex computation, especially in the cost of equity. Theoretically, the cost of equity is equal to the earnings that shareholders expect in the stock market. However, the process becomes more complex for the company which is not yet listed on the stock market as its own earnings are not available. In this case, the cost is estimated by using a proxy company. Due to the complexity, ROR has been left untouched in LRIC discussions. However, sooner or later, ROR would be revisited as its impact on the telecommunications industry is critical. About twenty to thirty percent out of the total cost is composed of the return on investment. Therefore, study on the ROR is necessary in the countries considering LRIC. The ROR is influenced by the degree of political, economic and commercial risk in the country. Therefore, its level would be higher in developing countries where financing and operation is riskier than in stable countries. Investment for the new network may require the higher ROR than that for the old network.

4. Findings and Lessons

No Hurry

Countries which have not yet adopted LRIC but are considering to adopt LRIC have to conserve enough time to study and to localize the methodology. Costing methodology is very important and has great impact on the industry. The goal has to be put on the appropriateness, not on the swiftness. As shown in advanced countries, it takes several years to develop a relevant costing methodology. Testing period to examine its impacts on the market also necessary. Longer time would be taken in the less developed countries because their academic infrastructures and know-hows are behind the developed countries.

Not Newer But Better

For long time, the fully distributed costing methodology has been criticized due to its common cost allocation. The main theme of this criticism is that allocation is arbitrary and irrelevant. As an alternative, mark-up system is proposed in LRIC. However, the problem is not solved in LRIC because its treatment is neither more scrutiny to reflect the cost driver nor proven to be more accurate. As the mark-up is usually a certain proportion of direct cost, distortion could be aggravated if the direct cost is not relevantly collected. The distortion becomes larger if the ratio used in the developed country is applied in low-income country without considerations on the country specific characteristics. The mark-up measurement should not be used just because it is new model. Better way, not newer, is to be adopted.

Back-up Systems

Back-up systems such as rate-restructuring and universal service funding have to be prepared before implementing LRIC. Without these measurements, the telecommunications industry, especially the local company could be collapsed. As LRIC decreases the rate level of interconnection and local revenue as a result, access fees and the universal service funds should be increased in order to recover the loss. However, the countries which have political bottlenecks in increasing local charges, have to consider long distance access charges such as SLC or PICC in the U.S. Transitory period are also going to be needed in these countries while both per-minute local access charge and universal service fund are charged simultaneously.

Cleverer Macro-economic Policy

Under the LRIC, macro economic policies such as universal service, network expansion, protection on the local manufactures could be disabled in developing countries. These policies could be non-economic but sometimes necessary for the countries which are in the initial stage of development. However, the model does not allow any non-economically incurred costs. Therefore, the countries which need non-economic macro economic policies have to develop and execute them cleverly. Co-ordination and co-operation between developing and developed countries might be necessary. Adjustment on the level of ROR and mark-ups would be the one possible way that countries could develop to achieve macro-economic policy goals.

5. Conclusion

The study is executed based on the scattered written materials. In-depth research is interrupted by inaccessibility to the internal decision-making process. The research, however, investigates the major issues raised by the countries, undertaking cost-based pricing principle pursuant to WTO Agreement. In sum, LRIC has been spread out since the WTO Agreement while a costing methodology being standardized. Without fully understanding it, countries have adopted the methodology as others preceded or persuaded them. Actually, there are few countries that could develop the LRIC model for themselves. Some countries have no ability to verify if the model is appropriate to them. Mark-up system in LRIC does not solve the common cost problem embedded in FDC. Country-specific characteristics such as traffic pattern and market size are not fully considered. Radical changes in universal service system and pricing structure are inevitable. Macro economic policies such as network expansion and protection for the home manufacturers in the low-income countries could be disabled. This study suggests that countries have to develop costing methodology for themselves. It would take long time for them to understand and develop their own costing methodology, and to solve the problems found above. Therefore, countries need to take the following attitudes on the LRIC: Do not hurry, Be sure better way, Prepare back-up systems and Create clever macro-economic policies.

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Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

$ Economics & Financing

Monday, 15 January 2001
1100–1230

M.1.6 Infrastructure Development

Chair: ELLEN HOFF, President, W.L. Pritchard & Co., L.C., *USA*

M.1.6.1 Asian Technology Parks: Lessons for the Digital Divide (ABSTRACT)

RICHARD TAYLOR, Palmer Chair in Telecommunication Studies, The Pennsylvania State University and MEHEROO JUSSAWALLA, Senior Fellow/Emerita, East-West Center, *USA*

M.1.6.2 Services to Entrepreneurs in the Undersea Cable Industry (ABSTRACT)

JEAN-CHARLES LEZEAU, Head of Strategy & Analysis, Alcatel Submarine Network, *France*

M.1.6.3 Internet commerce Models in Asia: Case Study on Singapore and South Korea (ABSTRACT)

WONGSUK KANG, Assistant Professor, Nanyang Technological University, *Singapore* and BRIAN LEE, Ph.D. Candidate, Nanyang Technological University, *Singapore*

M.1.6.4 Techniques for Financing Telecoms and Internet Infrastructure Buildout in Asia (ABSTRACT)

GLENN GERSTELL. Managing Partner and ALISA FIDDES, Senior Associate, Milbank, Tweed, Hadley & McCloy LLP, *USA*

Asian Technology Parks: Lessons For The "Digital Divide"

Richard Taylor and **Meheroo Jussawalla**

Abstract

INTRODUCTION: Bridging the "International Divide"

The task of redressing global inequalities in access to communications technologies is an Herculean one calling for huge investments in infrastructure and human resources. The benefits to society and the economy are equally enormous and worth striving for. The Global Digital Divide is an integral subset of the issue of globalization . Globalization is driven by the accumulation of investments in information technology, which enhances the knowledge base of developing countries. It empowers developing nations to use that knowledge base for the economic development of their people and in the long run to reduce the digital divide. Many developing nations are using development of information-based Technology parks as their primary strategy for promoting Foreign Direct Investment, technology transfer, R&D, employment and overall economic growth, all of which affect the Global Digital Divide.

Collection and analysis of such strategies are being implemented, and whether they are achieving their goals, can significantly inform policy makers on strategies for reducing the Global Digital Divide(GDD), advancing distributional equity, and softening some of the negative effects of economic globalization. There is a digital divide in the advanced countries just as much as there is in the developing countries. But the determinants are different. In the developed countries the divide is marked by the minorities lack of access to sophisticated telecommunications resources (Leahy and O'Brien *Intermedia, September 2000 Vol28/5)*. For example, in the United States approximately 70% of the population has access in some form or other to such resources, and 30% is without access. In the GDD there is disparity between nations and internally as well. Whereas in both there is a degree of deprivation, in the advanced economies measures are taken to reduce the divide. Although the tools and methods used by the advanced countries can be used as models for the emerging countries to find solutions , the differences in political systems, stages of economic development and cultures will have to be taken into account. Whereas in the technologically advanced nations, universal access is the goal and disparities are being reduced through regulation and liberalization. Through an active role played by the private sector and its contribution to the National Information Infrastructure, it becomes possible for the digital divide to be reduced faster in advanced countries than in the low income ones.

This paper will describe a study undertaken by the East West Center to tackle some of the development issues for reducing the GDD and the role of information technology in economic development.

The Global Knowledge and Information Society. According to Hans d'Orville , Director , IT for Development Program, Bureau for Development Policy, UNDP, notes that as the world is globalizing, a global knowledge and information society is emerging, spanning all regions. Knowledge and information have become significant factors for production and services and acquire ever more importance. They affect the international division of labor, determine the competitiveness of economies and corporations, generate new growth patterns and in the process spawn new products, jobs and livelihoods.

Being generic, the information and communications technologies which drive these processes cut across all sectors and impact virtually on all human and societal activities. They are a means to advance the knowledge society and serve as a transmission belt to generate success, disseminate knowledge, data, information communications and best practices at all societal levels. These technologies also have one more intriguing characteristic according to d'Orville, 'they allow leapfrogging, which means that their developing societies can leap across several generations of stages of technology, introducing and applying directly state-of- the- art technologies. They also do not have to scrap old technologies as developed economies do. For example they do not have to dig out copper wire to install fiber optic cable. They can connect remote areas with wireless networks through mobile satellite systems as is now being dome in SubSharan Africa and villages in India. The former has been given low cost satellite connections by Intelsat and the latter by the ICO(a subsidiary of Inmarsat).

The Challenge of Equitable Access

Assuring equitable access to digital technology to bring the benefits of the "new economy' to developing countries is now widely recognized as one of the most significant challenges of the new century. The concept of the GDD is an integral part of the public discourse on globalization caused by IT and its impact on society. Major forces transforming the world social order in the current millennium, are the phenomenal growth of the Internet, the wireless revolution, large volumes of cross border information flows all of which have been fuelled by the new global knowledge economy. No country can afford to live in isolation today and escape the impact of the IT and yet a majority of its citizens and is in China, Cambodia, and India cannot afford to use such devices. In the past two decades, the International Telecommunications Union(ITU) has convened many commissions to bring equity in access from the McBride Commissions Report called *Many Voices One World* to the Maitland Commission's Report called *The Missing Link(1989),*which urged high income countries to help install at least one telephone within twenty minutes walking distance from a telephone in every village around the globe. These recommendations had a significant impact on many developing countries in Asia whose governments started to ascribe priority to telecommunications in their national budgets so that the ITU set up a separate Bureau for Development Communications and WorldTel to finance such basic services. To cite Lester Thurow*(Building Wealth, Atlantic Monthly , June 1999),* it is no longer natural or mineral resources that create wealth, but a knowledge-based economy. This new knowledge-based economy is asking new questions, giving new answers and developing new rules for creating new wealth. Developing countries face complex challenges in the allocation of scarce public resources to successfully integrate into the global economy ad to find the capital, the equipment and the expertise necessary to achieve their goals.

International institutions recognize this issue and are preparing to help. For example, World Bank President James D. Wolfensohn, speaking to reporters at the conclusion of the World bank and IMF meeting held in Washington D.C. in the spring of 2000 said that closing the "digital Divide" is a 'central aspect" of the World's Bank work. He said that the Bank needs to ensure that the digital divide does not make the gap between the rich and poor countries even wider. According to him the access to information is a public good and his support for privatization of the telecom and information infrastructure in the developing world is strong. Earlier in the mid 1990s, Pekka Tarjanne, then the Secretary General of the ITU had asserted that access to information was a fundamental human right and should be upheld by the UN Human Rights Commission.

Likewise, the Administrator of the UN Development Program (UNDP) in a gathering of world leaders in Davos on January 31,2000, noted that "the goal must be for information technology to deliver revolutionary breakthroughs in terms of giving the world's poor , access to the global economy. If this is not done, the digital divide will grow. Corporations will stick to markets they know. Developing countries will keep their doors closed and opportunities and access will be denied to millions of small entrepreneurs in the developing countries" The UNDP looks towards solutions in its *Human Development Report 1999: Globalization With a Human Face* recognizing that what is needed is foreign direct investment(FDI). However, the Report asks, what does it take for FDI and growth to contribute to human development? First investments in infrastructure and services should have a direct impact on human development: second, FDI must be tailored to national priorities, in activities that have spillovers- in creating more employment, bringing in high technology, building future human capital: and third, countries need to minimize the adverse impacts of FDI (such as creating inequalities), provide domestic enterprises with necessary incentives, and protect their interest. The Report states that purchasing a computer would cost an average person in Bangladesh eight years income compared to an American for whom the cost will be a month's income. The Report cites another example of Monaco having 99 telephones lines per hundred persons and in Cambodia just one. The old dogma of "the culture of poverty has to disappear under the spread of the knowledge society and its transforming power.

There are human costs to the triumph of globalization. Business, society and the environment are partners in a global alliance. It is not an alliance formed out of political necessity but out of economic needs. Fed by new technology and liberalization of national telecommunications markets, developing countries want to find their way into the mainstream of economic growth which would translate onto higher standards of living. Despite the advantages of distance education, and tele-health there is a gaping void between the information haves and have- nots. This digital divide is more marked in the realm of computers since 97% of all host computers are found only in the group of 28 countries that constitute the OECD which constitute one quarter of the world's population.(Mody, Bella , "The Internet in the Other Three quarters of the World" *The Journal of the Institute of Information Studies, 1999).* This prosperity gap is not a new phenomenon but becomes acute when economies of advanced countries like the U.S.A. are powering along providing jobs and mobility for all .

World Bank GDD Initiative.

On February 12, 2000 in what was described as "the most significant single initiative yet to start to narrow the Global digital divide and jumpstart the new digital economy in the developing world the International Finance Corporation joined the SoftBank Corp. of Japan to spawn Internet companies in 100 developing countries. Together they invested US$200 million to found SoftBank Emerging Markets (SBEM) to incubate Internet –related businesses in developing countries. SBEM will nurture new Internet enterprises both by investing seed money and by providing an array of technological, legal and management support to turn ideas into solid businesses. SBEM will serve as an accelerator to speed the creation of Internet anchored enterprises in developing countries by working with a network of global industry leaders and local partners. These are the same principles underlying investment in Information Technology Parks.

"The digital divide is one of the greatest impediments to development and is growing exponentially" said World Bank President Wolfensohn. "With this initiative, we are taking a lead in the effort to close the gap. This investment will accelerate the inclusion of the developing countries in the information revolution. It will transfer technology from the rich countries to the developing world, fostering sustainable new local businesses, which will promote prosperity and reduce poverty. And it will, I hope encourage others to follow with their own investments and initiatives to establish technology and information centers all around the world."

UNCTAD Takes aim at Technology FDI

The UNCTAD is also trying to move from theory to practice in this regard. At its tenth session in Bangkok(12 –19, February 2000), it issued its Plan of Action (TD/386, 18 February2000) . The Plan concludes that UNCTAD should address issue soft technology and enterprise development, including their relation to investment. It should aim at improving the understanding of developing countries and economies in transition with respect to policy choices in these areas; strengthening these countries' national abilities to formulate and implement policies, measures and action programs in these areas; and promoting understanding of emerging issues.

In the area of technology, UNCTAD's analytical work should aim at drawing lessons from experiences with the transfer and diffusion of technology through FDI and other channels with a view towards supporting efforts made by developing countries to respond to technological and scientific changes and seek to explore ways in which an environment conducive to the transfer and diffusion of knowledge can be fostered , as well as various models and mechanisms of transfer and diffusion.

Thus it is clear that organizations such as The World Bank and the UNDP and UNCTAD recognize the importance of the issues around FDI, technology transfer, diffusion policy and policy that are critical to addressing the GDD. The underlying principle of this recent public discourse, however, are not unique and ahistorical. In fact there is a substantial literature of economic theory, information technology and growth. The East West Center study will place current developments in the context of economic theory.

Economic Theory and IT Growth

Neo classical growth models such as those of Harrod Domar and Solow relied on investments in capital goods to generate high capital/output ratios and to rely on self-sustained development. Such models sometimes created problems for developing countries with excessive foreign exchange debts and adverse balance of payments. Growth models moved from balanced to unbalanced growth . As far back as 1967, Baumol proposed a model for unbalanced economic g in which the economy was composed of two sectors: a "productive sector" in which productivity grew exponentially and a stagnant sector in which productivity remains constant. Baumol then introduced a third sector which uses fixed proportions of both sectors (like television broadcasting and computer usage) which provides the most high tech activities and is in the vanguard of innovations and change.(Baumol, 1984). Even to day in the US economy with the huge spurt in growth and accumulation of wealth, we still have to stimulate innovations to keep the dynamism in GNP growth at 3.5% or more.

Despite its emphasis on equilibrium and "perfect knowledge" economics has not failed to consider the role of technology in development. The major issues of concern are the economic variables that are endogenous to planning in light of rapid advances in technology. According to Lamberton(1982) the information sector has emerged as part of the social accounting system of information sensitive societies. The conventional assumptions of economic theory stand challenged today, because of a new model of optimal resource allocation that will account for the informational and institutional characteristics of an economy, be it advanced or emerging. Such a model based on information technology as a determinant of growth is used to analyze the micro foundations of economic growth.

For example, international trade aims at linking product flows and information flows and becomes an option for developing countries to invest in as a leading sector in their growth plans. So far the attempts by the GATT, the UNCTAD and the WTO to cut across frontiers to expand the volume and value of international trade have met with limited success. However, IT tends to reduce these barriers in cultural and economic terms so that the flow of appropriate technology assumes transnational importance and makes IT an important generator of growth. Many controlled economies like India and China where information is treated as a public good to be supplied only by the public sector, market decisions still have to be made to smooth out market imperfections in a command economy. Therefore, it is important to smooth out market imperfections to explore the dynamics of economic change in IT investment and consumer choice as is followed in our project.

There are diffusional and distributive effects associated with IT projects that arise such as

1. Investment based on simple rates of return or are there broader societal goals as of distributional equity

informational equality?

2. What policies should developing countries adopt for the use of IT in telemedicine, tele health, distance learning for remote areas?

3. Do diffusion effects become obvious as the Internet and E Commerce generate a phenomenal demand for those networks which motivate middle and lower income groups to improve their skills and obtain gainful employment (as in India's software sector)?

4. What is the potential impact of these effects (positive and negative) on the digital divide?

In the 1970s studies were confined to the Information Sectors of the OECD countries. Marc Porat used the Leontief type input-output models to assess the increasing contribution of IT to the GNP of the United States in both absolute and relative terms. Fritz Machlup analyzed the "production and distribution of knowledge in the United states". The East West Center in collaboration with the University of Queensland carried out similar studies for Ten Pacific Countries in the early eighties and provided indicators for public investment (*The Cost of Thinking, 1984 ed Jussawalla, Lamberton).*Today information is treated NOT as a residual in growth models but as a key factor in the development of the socio economic system.

As evidenced by the Asian financial crisis 1998, markets are not real generators of efficiency even in the theory of pure competition as argued by Helleiner(1978). Markets become creatures of political and social systems and the factor intensity of trade becomes dependent on information intensity in assessing the terms of trade (Jussawalla,1993).

The policy relevance of a study of IT parks and of the impact of investment in them as it relates to the GDD and economic growth assumes significance in the light of rapid technological changes in digital technology. The enormous advances made by the NIEs (Newly Industrial Economies) over the last two decades have been based on the centers of production, assembly and design in IT activities and started to rival the two economic giants of the region namely, Japan and the United States. This trend has significant ramifications for trade relations, employment patterns and the growth of multinational corporations (MNCs) . This altered the factor productivities for trade in the region along with a growth in demand for human capital. The economic implications of investment in IT include the creation of new markets, changes in existing ones and increase in national productivity. Central to this growth process is the fact knowledge becomes the production process itself and transforms itself into a factor of production like capital and labor. Vital to this new mode of production is the convergence of computers with telecommunications and entertainment. The creation, use and transfer of technology bring about dynamic network externalities, which result in incremental innovations. Therefore, a study of IT Centers becomes relevant in the overall context of investment policies directed towards rapid economic development. With the decline in the costs of IT products and the high returns on investment, both economies of scale and scope come into play in such Centers advancing the flow of higher investments in them from domestic and foreign sources. According to Paul Romer (*Wired, June 1996)* the world is not defined by scarcity and limits to growth, but becomes a playground for unbounded opportunity, where new ideas beget new products, new markets and create new wealth.

Limitations and Exclusions

The study only provides baseline comparative data on IT Parks in five countries and the lessons for Hawaii. It discusses how investments in IT Parks addresses the Global Digital Divide and whether it helps to reduce it in regional terms. It offers insights into "Best practices" and economic impacts. Its data is derived from a survey instrument and interviews with government leaders and experts, and from published data and secondary sources. It is therefore, subject to the inherent limitations of that methodology. It does not address all the cultural and social effects of the presence of the Parks and of the increase use of IT outside issues of the GDD.

SYNOPSIS OF IT CENTERS IN ASIA

Singapore

Initiated by the Singapore government and in collaboration with the National Computer Board roughly half of Singapore's Science Park's 226 tenants are involved in the IT industry. The Arcasia Company in Singapore is promoting the Sceince Park's occupation of land and infrastructure. The Government has given quite a few tax incentives under the IT Plan2000 to attract state-of –the- art private ventures. Along with sophisticated infrastructure facilities, tenants are able to take advantage of Singapore's newly inaugurated US$ 8 million broadband fiber optic network called Singapore One. Major foreign tenants in the Park are Sony, Silicon Graphics, Lucent Technologies, Seagate Technology International and Exxon Chemicals .

Singapore is considered one of the world's most wired nations but often it has to pay a price for being so high up the technology learning curve. The StarHub Interrnet , which is the monopoly cable operator is not able to deliver internet access at the promised 25 times higher speed than dial up speeds. Also SingTel's Magix service is also being criticized for slower than expected service even though the services is ADSL-based. Despite this problem both platforms are well ahead in providing new services. Magix has a joint venture with Israel's Extent Technologies to offer an Application Service Provider hosting service. Over 100 educational CD-ROMs are available on that service.

The Singapore Broadcasting Authority has awarded five licenses to fast track the research and development process in the IT Parks and test HDTV . The Singapore government has set aside US$ 88 million to boost the interactive broadband multimedia industry and to double Singapore One's network subscribers. As part of the Island's Infocomm 21 Masterplan, most of the money will be poured into providing infrastructure for the new IT Park. The Industrial Park opened in April 2000 has an e-biz hub @Chai Chee as a joint venture between DBS Land and Singapore One. The idea is to jump start IT projects in the Park with low network charges. However to obtain regional exposure, content creators need to also provide narrowband services for interactive services on TV. Given Singapore's ability to stay ahead of its regional competitors, the question is about the ownership which is closely held and not likely to pass into the hands of non-Singaporeans.

Since its own satellite was launched in August 1988 in 88 degrees East longitude, SingTel and Taiwan's Chungwha telecom jointly operate the spacecraft from centers in both Singapore and Taiwan. At a cost of US$240 million the satellite's life span is estimated at 12 years. It carries 16 Ku band and 14 C band transponders. It provides digital DTH signals t Taiwan and Singapore will provide gateway internet facilities to Myanmar, Bangladesh, Brunei, Pakistan and India. This distribution system will further help the IT Park to attract more technopreneurs.

Bangalore, India

India's software exports have been growing at 50% a year in recent years, thanks in part to India's partly government owned and operated Software Technology Parks. The major Park in Bangalore is sponsored by the Government of Singapore in collaboration with the Tatas . Twelve STPs have been set up around the country including Bangalore, Pune, Bhubaneshwar, Noida (near Delhi with GE's operations there) and Hyderabad. Of India's $1.75 billion software exports in 1998. STP's accounted for $7,9 million. Now McKinsey estimates that in 2000 these will amount to $ 5.7 billion which is about 1.5 % of the total economy . India expects an income of $40 billion in 2000 for domestic revenues. This makes India the first Asian economy to rely on brain-power led growth.

Bangalore is by far the largest IT center in India . it is the hub of India's semiconductor industry, producing chips for Intel and Texas Instruments. Its source of personnel lies in the Tata Institute for Science and Engineering and the government's Space Research organization (ISRO) Two universities feed expertise to Banagalore's Silicom Valley, namely Bangalore and Karnantaka Universities. During the Y2K anticipated crisis India's software parks provided a wide range of net-related products to foreign companies from browsers on new generation wireless phones to e- commerce websites. India provided the software to foreign companies for debugging their networks in time for the Y2K.

Motorola's subsidiary , Ctitgroup's subsidiary called I Flex Solutions, Infosys and Wipro have been ranked high by the Carnegie Melon Engineering Institute's 21 ranked companies . Godman Sachs estimates that India's net users will rise from 2 million to 70 million by 2003 in consequence of the mushrooming of IT parks. India's software tycoon Hashim Premji has a company in Bangalore called Wipro with a market capitalization of $4.1 billion. Its strength lies in product developments and producing customized software solutions.

India's new Convergence Bill covers telecommunications, telephony, Internet, broadcasting and cable TV. Three hundred cable operators in Keerala have a joint venture to build a broadband cable network which will link around 130,0000 subscribers for providing internet and interactive services, promoting further the spread of IT centers.

Malaysia

The Multimedia Super Corridor (MSC) was envisioned as the flagship of the Malaysia Vision 2020 for digital age economy. It has been the Prime Minister Mahatir's ambition to compete with Singapore and to place Malaysia among the top-ranking IT generated growth centers. The MSC is a 15 kilometer by 50 kilometer corridor stretching from Kuala Lumpur' s City Center to the recently opened Kuala Lumpur's International Airport . Putrajaya is to be the home of the national government and located within the MSC.

Planned to deliver a number of sophisticated investment, business, R&D and lifestyle options the MSC is designed to be multimedia utopia offering a productive, intelligent environment within which a multimedia value chain of goods and services will be produced and delivered across the globe.

Within the MSC , Cyberjaya will be part of Malaysia's Vision 2020 and involves an investment of US$ 20 billion. The initial investment came from Japan's NTT which will jointly lay the backbone infrastructure with Telekom Malaysia. Microsoft, Sun Micro systems, Oracle, and Orion have already opened offices in Kuala Lumpur to enter the MSC. Despite the financial malaise in Malaysia and the capital controls instituted to counter its effects, none of the projected investments in the MSC have been curtailed and foreign interest is as strong as before. In September 2000, Bill Gates visited the Microsoft Knowledge Capital Center in Cyberjaya and looked at the web pages being made by the children in the center. At the inception of the MSC an International Advisory Panel was created in order to counsel Malaysia on appropriate strategies for attracting high tech foreign direct investment. The government put out a Bill of Guarantees for foreign investors acting on the advice of the IAP .The government has also established a Multimedia Development Corporation to create linkages with other high tech centers and also serves as a screening agency for new entrants to the Corridor. The goal of this IT Park is to transform Malaysia from a manufacturing based economy to a knowledge intensive society by 2020. Fiber optic cables are being laid at a fast speed to link the MSC with other IT parks in the region and internationally.

Taiwan

The Hsinchu park near Taipei is the core of the world's third largest high tech industry, accounting for a third of Taiwan's manufacturing exports and a very large share of the world's computer production. Now that Hscinchu has overflowed its boundaries, the Taiwan Government's technocrats are building a second science park near the southern city of Tainan. The aim is to recreate the suburban Northen Californis essence of Palo Alto with semiconductor factories, software start ups, venture capitalists and cappuccino counters that make the real Silicon Valley hum. Most of the outsorcing for Dell and Compaq computers is done in Taiwan by the employees of companies such as Asustek, Mitac FiC and Compal. In 1998 Taiwan became the world's leading producer of Notebook computers and called itself the Silicon Island. Taiwan owes its success to two factors. The first is its close links to the United States and the second is the commoditization of the PC in the eighties. It was the Taiwanese working in Silicon Valley who first spotted this trend and recognized that their country was the best place to locate all the no-name small component suppliers. Thereby the Hschinu park became the hinterland of Silicon Valley.

Mr. Kwoh –Ting Li was a minister of the government but he realized that the role of the government bureaucrats will be limited and encouraged private capital to establish the units in the Park. Today he is considered the father of the high tech industry in Taiwan. Mr. Li started a national laboratory called the Industrial Technology Research Institute and offered tax incentives to shared factory space. He also encouraged the start of a venture capital industry with a venture fund. The Hsinchu Park became a model for the country's economic future embodying every globalization trend from horizontal integration to virtual organizations. This small Park in Taipei now supports vast manufacturing and distribution facilities around the world and Taiwanese companies have now invested $80 billion outside the country.

China

China has the world's second largest market for technology equipment and services. It has in current use 15 million pagers most of which are domestically produced. It also imports over a ,million pagers a year. In 1998 China established its Ministry of Information Industries combining the Ministry of Post and Telecommunications with the Ministry of Electronics and the Ministry of Broadcasting. China's monopoly for telecommunications was challenged when in 1993 Unicom was established with two subsidiaries Liantong and Jitong. However China Telecom still holds the largest share of the telecoms market and floated its first IPO on the stock exchange. Its data network is called Chinapac covering 43 cities. It also has an educational network called CERN that aims to link 1000 universities around the country to the Internet by the end of 2000. China greatly liberalized its policies and formed joint ventures with AT&T, Northern Telecom, Alacatel for switch manufacturing and land lines and with Ericsson, Motorola, Nokia and NEC in the mobile communication sector. Chian accounts for 11 % for Ericsson's total sales and has 700 base stations for cellular services. China is also the largest user of VSATs (Very Small Aperture Terminals) used for TV and data transmission.

China has invested in two major high tech development centers: Beijing Shanghai High Tech Development Zone and Shanghai Pudong Economic Zone. The former is located 20 kilometers west of the capital city and was established in 1`993 with the support of the Beijing provincial government. The electronic industries located there have a high rate of growth in manufacturing PCs, computer peripherals, optoelectronics, microbiology and pharmaceuticals. It s incubator units are getting filled up rapidly as the IT sector expands

The Shanghai Pudong Economic Zone is located east of Hangpu River and is the largest special economic zone in China. Established in 1990 ir has become the favorite location of Foreign IT Investments which are likely to grow now that the government has allowed 49% ownership of joint ventures by foreign investors. Shanghai Bell Telecom equipment Company is a joint venture between the MII and Alcatel of France and is the largest joint venture in telecoms in China located in Pudong. Other multinational located there are Sanyo, Siemens, Intel and IBM. A total of 200 multinationals are located in Pudong with a total investment estimated at $15 billion.

These High tech parks serve as models for the high tech growth of Hawaii which has numerous advantages in infrastructure, land, human resources and the advantage of two time zones. There is every possibility of making the island a igh tech center between America and the Pacific but so far it has not attained that status. Maui's high tech ark has succeeded to a considerable extent with most of its incubators operating around the Super Computer installation . Another promising IT Park has emerged rapidly at Kapolei, which at first, was called the second city bit now constitutes to being a city on its own. It has its own teleport and incubators for high technology companies. Most recently it acquired a pharmaceutical company. It is fully wired with fiber optic cable and broad band facility for wireless communication. Its residential areas within the Park make it convenient for the labor force, making it cheaper for transportation costs. It has become a privately funded technopolis with a special mission to spur the high tech growth of Hawaii and boosting its slowing economy. With the prospect of Asians connected to the web surging past US figures, in the next few years , Kapolei holds the promise of fast internet connections to the Pacific region with the development of E commerce. In the next decade the most important technologies will be B2B, broadband and wireless and Hawaii should be able to advance in all three with its two IT Parks in Maui and Kapolei.

Conclusion

Responding to the call from the leaders of the G-8 to bridge the GDD, anew initiative to be known as *OpportunITy* was launched in Okinawa Japan in July 2000 by the UNDP and Anderson Consulting. This initiative will design a strategic approach to mobilize action from the international community to assist developing economies in pursuing opportunities offered by the ICT (Information and Communication Technology) revolution. Therefore it is widely accepted that the power and efficiency of the ICT and the Internet to promote sustainable development in developing countries is a reality and needs to be encouraged by policy makers both in the public and the private sectors. As such the study done by the East West Center of IT Parks as an instrument for bridging the Digital Divide blazes a trail and hopefully provides guidelines for more research in this area. Unless low income countries are saved from "falling through the net" as the US Department of Commerce calls it there will be little hope of bridging the digital divide either domestically or internationally.

Back to top of page **Back to the sessions page**

Services To Entrepreneurs In The Under Sea Cable Industry

Jean-Charles Lezeau

Abstract

Building a business plan in itself is a project. It requires Resources, Funds and Time.

A business plan is not just about spreadsheets showing expected financial results. It's initially inspired by the visions projected by entrepreneurs. At the end of the day, fund raising is based on a strong belief, by venture capital and suppliers, in the leadership of the project: People first, Technology second.

It is a must for entrepreneurs to establish long-term relationships with their suppliers (financial and technological) so that long term business strategies and requirements can be integrated into in the project's structures from the outset. Customer's confidence can be enhanced by offering them a set of integrated services, ensuring that all activities to be undertaken are identified and integrated into one plan.

The services will then cover all aspects of the project from inception through to operations. The aim of this approach is to help the customer to stay focused on its core business.

This paper gives an overview of experiences in developing business plans in the submarine industry and promotes an integrated service approach in this field. It describes the different activities undertaken and the content of a full business plan which gives Entrepreneurs the means to sell their vision. This paper outlines the relationships between the development of a business plan and the supply of services, along with how the two can be combined in a win-win proposition.

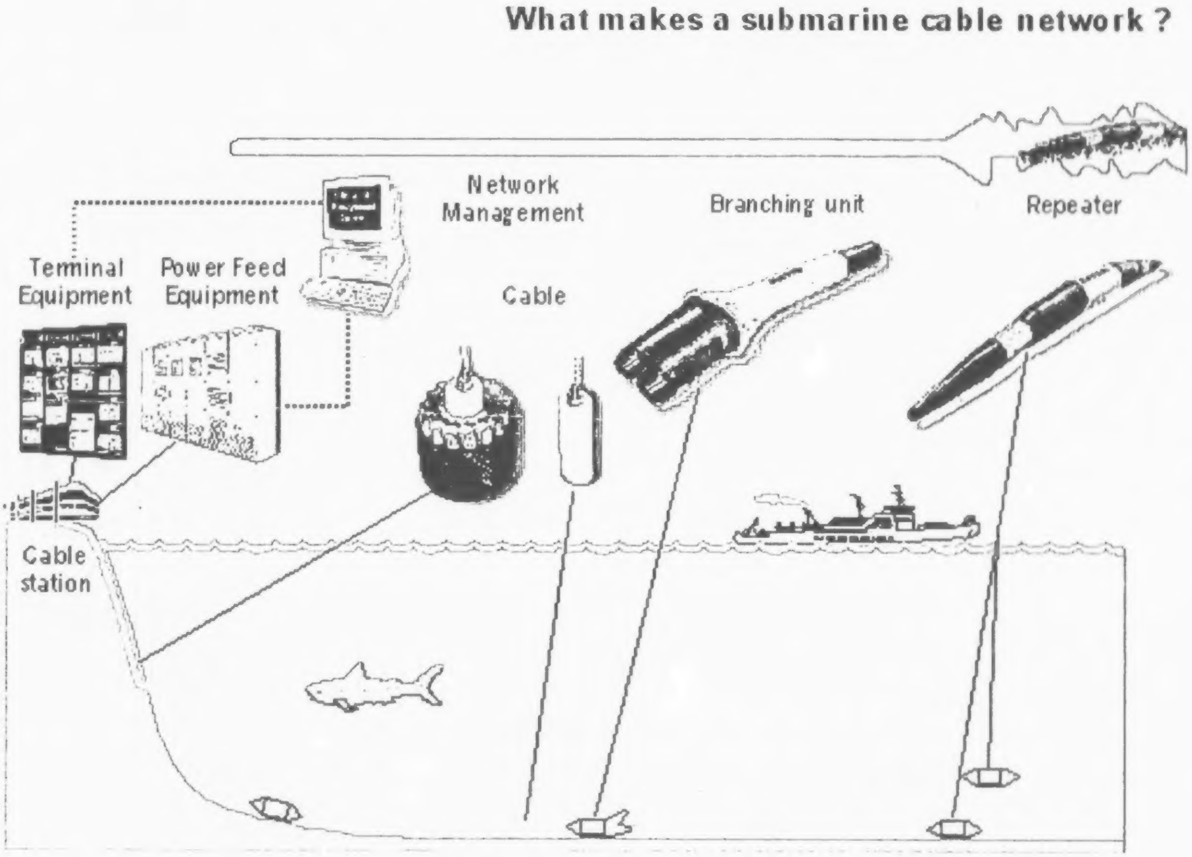
Services to Entrepreneurs in the Undersea cable industry

- Industry outlook.
- Who are the actors and the interactions?
- What are the challenges of the creation of a new system
- What services do entrepreneurs need?
- A framework for service creation

Introduction.

In the past three years, we've seen the undersea industry changing drastically. Moving from a monopolistic environment towards deregulated markets where private entrepreneurship can exploit business opportunities.

A conjunction of different factors have impacted that industry. Beside the deregulation, the explosion of the internet with its exponential growth rate and technological innovations in optics (e.g. WDM) are the other factors that have led to the attractiveness of this industry to private finance.


What makes a submarine cable network ?
Network Management
Branching unit
Repeater
Terminal Equipment
Power Feed Equipment
Cable
Cable station

Until 1998, some 20 bUS$ have been invested in the submarine telecom systems, and from 1999 to 2003 some additional 50 US b$ are planned to be invested.

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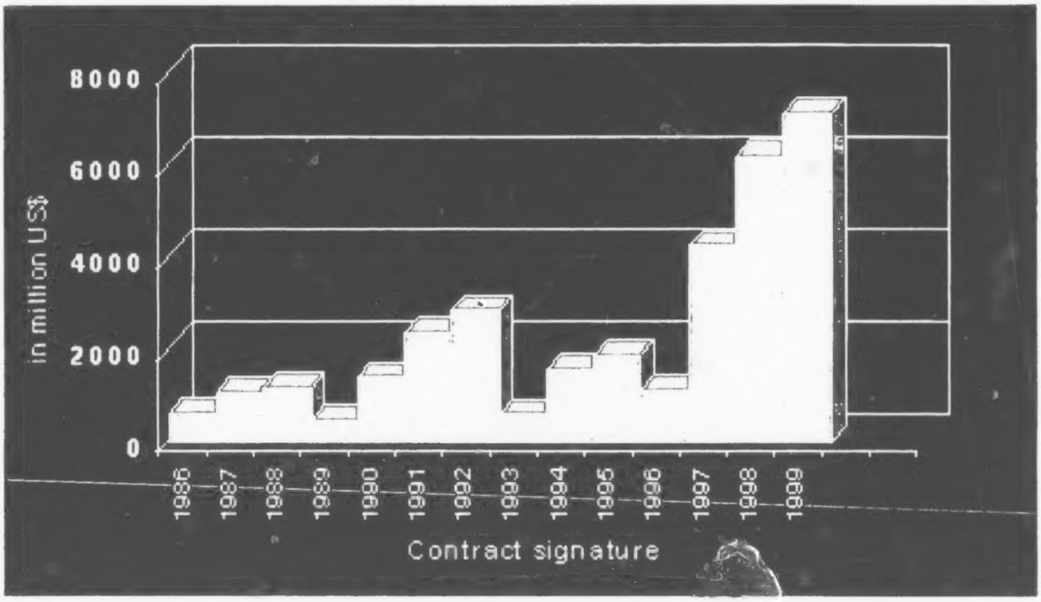
Worldwide market for submarine cable systems



In addition, at the same time, good financial market conditions have enabled the funding of ambitious business plans.

In the following, the complexities of building such business plans and making the project a reality will be described, with an emphasis on the interrelationships between entrepreneurs, suppliers and investors' expectations.

Entrepreneurship in the submarine business.

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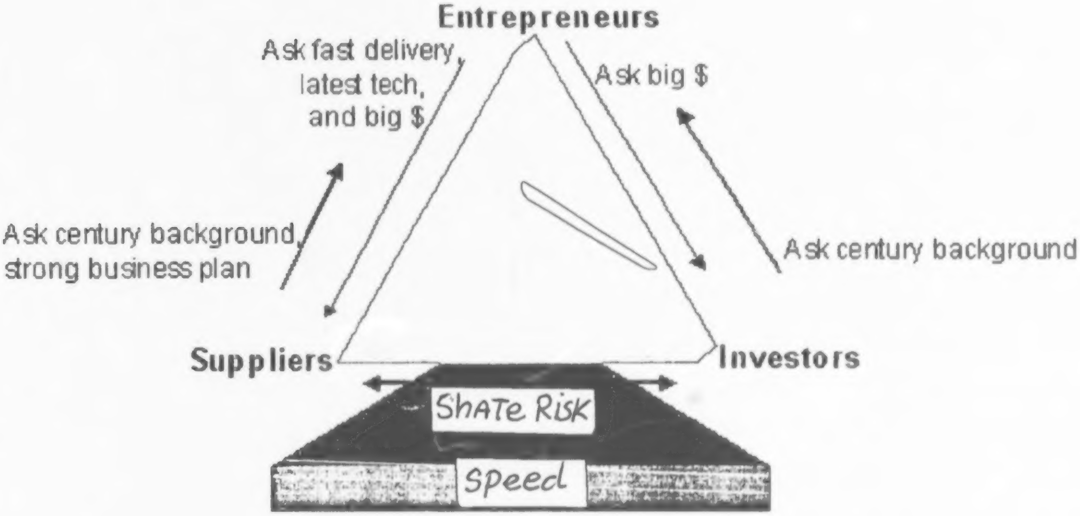
Entrepreneurship in the submarine industry


Entrepreneurs
Ask fast delivery, latest tech, and big $
Ask big $
Ask century background, strong business plan
Ask century background
Suppliers
Investors
ShaTe RisK
Speed

From a supplier's standpoint the last three years have seen a dramatic change in term of customer base. PTTs have been the traditional customers of submarine suppliers. Projects were initiated by consortium, what we call today the club system. Well known processes to answer to RFQ were the rules to get the contract.

Then, new types of customers appeared which were much more business driven, looking for shorter returns but focused on building an alternative to PTTs. We can name FLAG, Gemini and Atlantic Crossing 1 as some of the early comers. And these projects were not "shy" alternatives. Flag is a 28000 km, 1 b US$ project, Gemini a 12600 km ring system worth 420 m US$ and Global Crossing AC-1 a 12900 km ring system worth 640 m US$.

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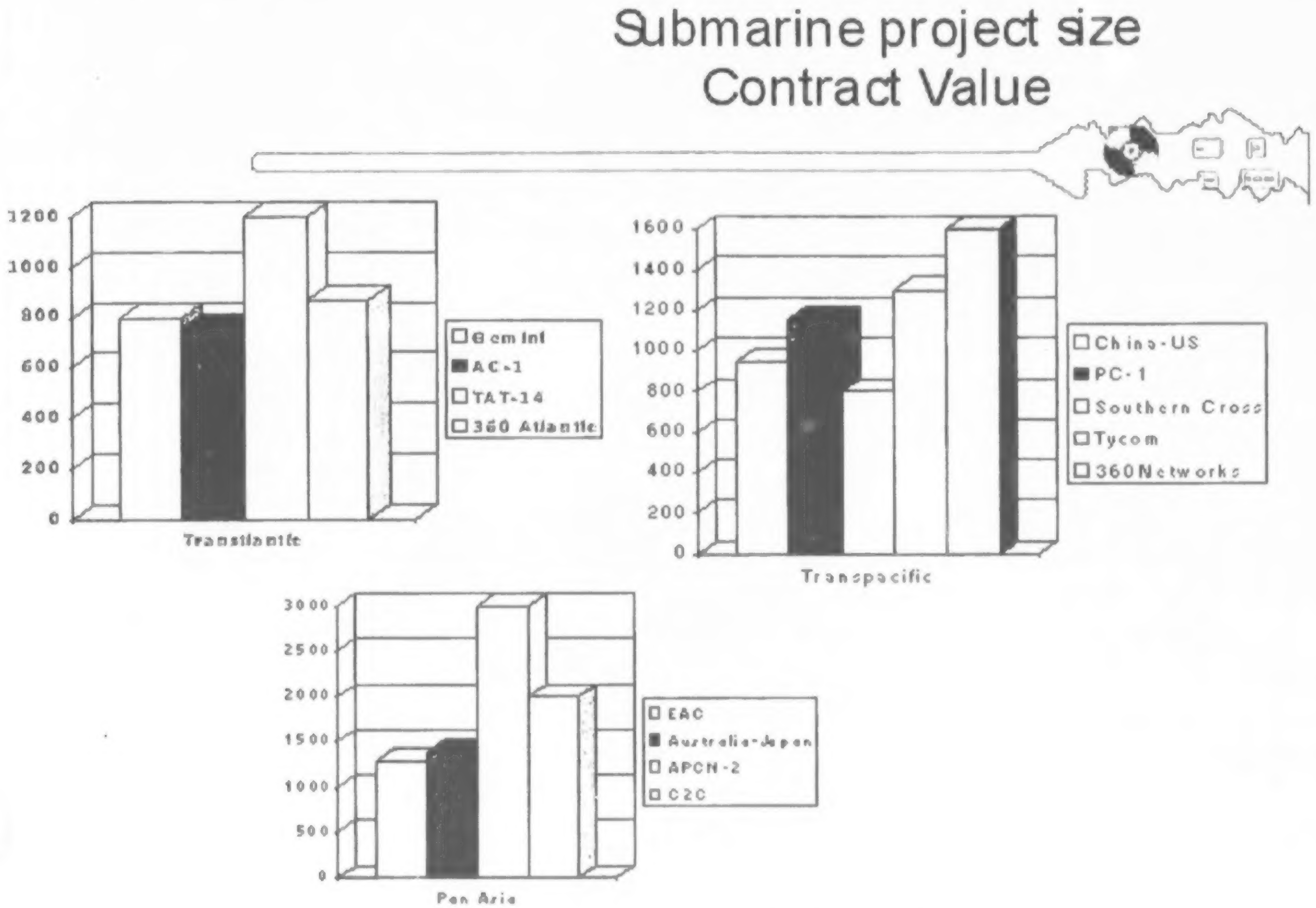


Submarine project size Contract Value

The size of these example gives a hint on the amount of the investments in this industry, hence the height of the barrier to entry for entrepreneurs.

As in any industry, entrepreneurs have to overcome many hurdles, but can be helped in doing so.

Entrepreneurs can be of several types, meaning with different backgrounds. One can be a financial investor, one a veteran of the submarine industry. But they have in common to have limited resources, whether it is finance or technical expertises, and time.

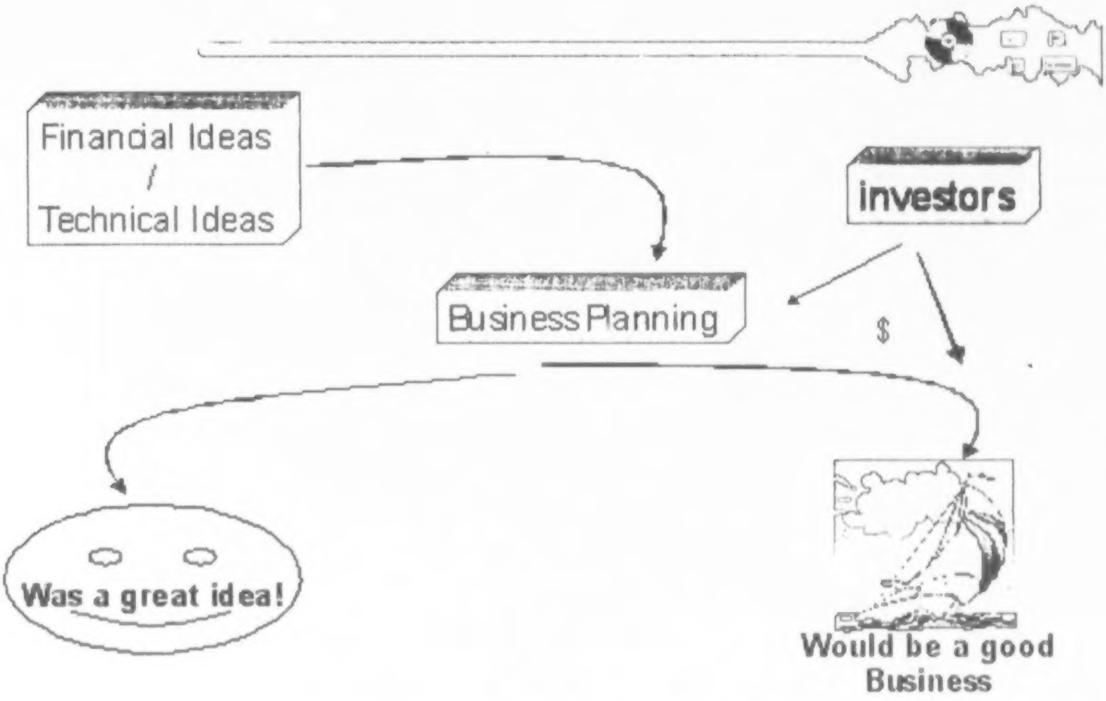
New challenges for Suppliers.

The business needs of these entrepreneurs induce new challenges for suppliers.

These challenges are of two types. The first is the need of a new skill-base; suppliers have not only to be responsive to technical RFQ but also to business requirements such as strategic positioning or financial capabilities. Suppliers are asked to take financial risks as well as technological risks. The second is the need for flexibility in terms of offering, meaning that system design and technical requirements are not as precise as they used to be; a more pro-active approach is needed to use off-the-shelf elements and still propose innovative solutions. Improvement of delivery time for cable systems would be a consequence of such change.

The Path to "Live" business.

The Telco's creation process



Financial Ideas / Technical Ideas

investors

Business Planning

$

Was a great idea!

Would be a good Business

Developing a market vision, sizing the project in term of technical requirements, financing requirements and time scale, selling the project to a wide community, and setting up the company structures are the necessary activities to be undertaken to make the vision a reality.

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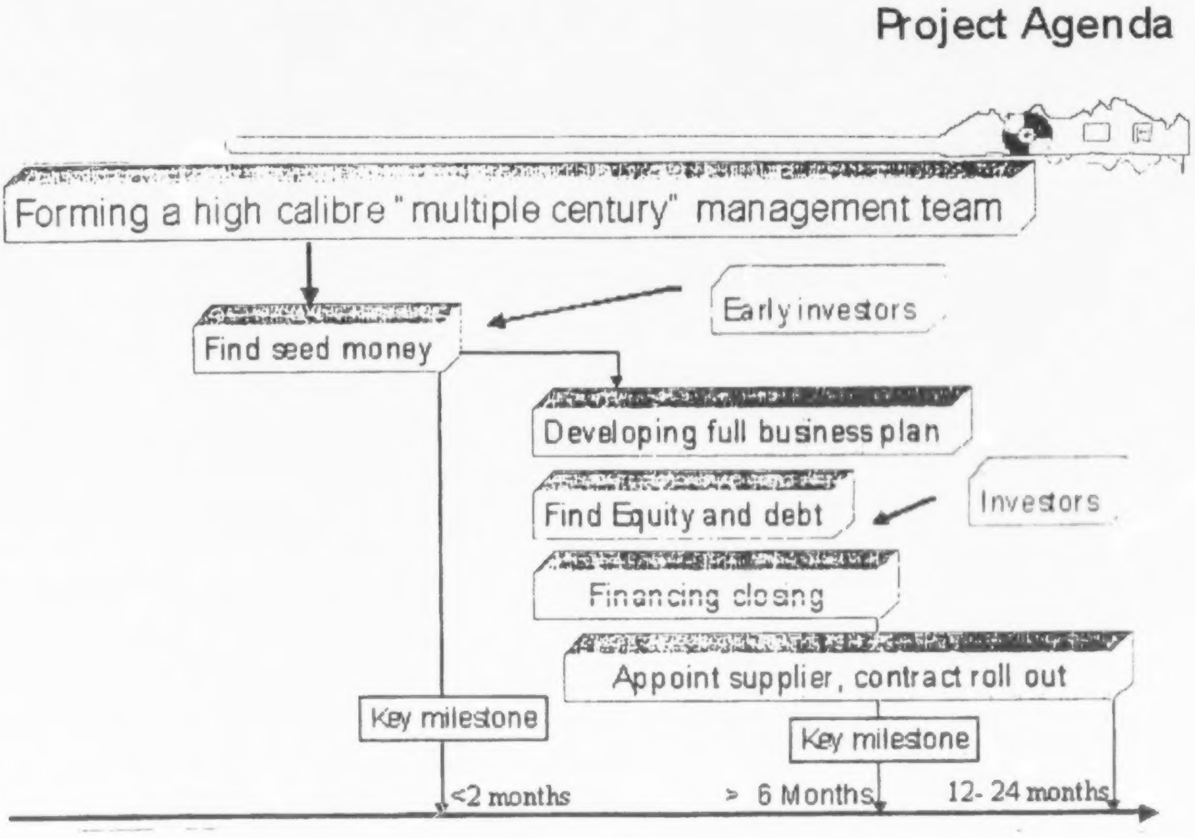
Project Agenda
Forming a high calibre "multiple century" management team
Find seed money
Early investors
Developing full business plan
Find Equity and debt
Investors
Financing closing
Appoint supplier, contract roll out
Key milestone
Key milestone
<2 months
> 6 Months
12- 24 months

As competition increases, time predominates the agenda. We've seen periods as short as 6 months from project inception to start of manufacture. Which is quite a challenge, especially when securing finance and finding partners is a pre-requisite, and yet used to take at least 1 to 5-years.

However, some mandatory milestones must be set. For instance, in the development phase, entrepreneurs must ensure that they have enough seed funds to reach the financial closing step. Another example is the link between the market competitive advantage that the project claims to have (usually being the first to go "live" on a given route) and the RFS date of the system, which means that contract signature must happen early enough to secure this RFS date.

Unfortunately, contract signature would happen only if financial closing is achieved, i.e. the project is fully funded. From a supplier standpoint this would secure the payment of the system(!), but also ensure that the manufacturing slot can really be booked.

Different solutions are offered to the Entrepreneur to move his project forward more urgently: First, he can find "early" customers to pre-sale his products, the capacity of the cable system. A second solution is to ask the supplier to invest in his project; investment can be of many types, either human resources, or finance (equity or debt). A third one is to spend a smaller amount of money in order to book the manufacturing slot by signing an "Intention To Proceed" agreement. These three solutions would smooth the way to financing closing. Not all solutions are available to everybody, especially the first two.

Actors' Expectations: Building a long-term relationship.

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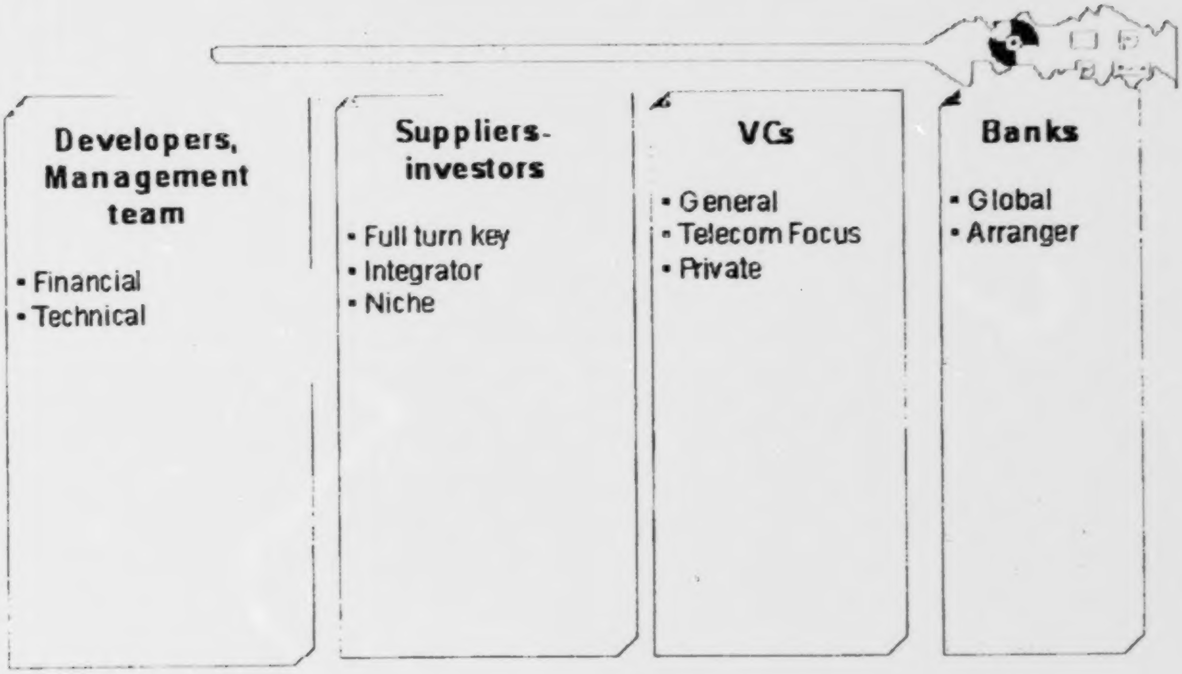
Actors



Developers, Management team

- Financial
- Technical

Suppliers-investors

- Full turn key
- Integrator
- Niche

VCs

- General
- Telecom Focus
- Private

Banks

- Global
- Arranger

Obviously, the players in the creation of these new telcos share a common goal: The profitable "happening" of the project.

The time frame of the entire project would be from 6 months to 10 years. Intermediate lengths can be envisaged for some players with pre-determined exit strategies, for instance for the early investor (equity investor, VCs) who committed to stay only in the early years of the operations.

For the long term, the relationships between players must be established with a clear set of rules right from the beginning of the project.

Entrepreneur's expectations.

This is a constraint for the entrepreneur which must ensure that he will have available the necessary resources, both technical and financial, throughout the business plan and not only at the first investment stage. So, his business requirements must be clearly identified and integrated in the suppliers' offers.

This is the fundamental reason to offer to these entrepreneurs an integrated services approach which will "bring together" all the elements of requirements and activities to be carried out during the whole life of the project.

Suppliers' expectations.

From a supplier's perspective it is crucial to establish a long term relationship because these new projects are more complex involving more parties and different interests. It will commit to long term support in terms of

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commercial warranty and technological upgrades.

The way to contract signature will depend on numerous factors and events which will impact the overall relationship.

Negotiating the relative participation in the new business is at the heart of the financial commitments from financial investors and also from suppliers.

The competitive advantage of technological "first", or first "live" on the market has a value in the funding plan, as much as the "vision" has; thus the entrepreneur has to be rewarded for that. In the early stages, fair and open negotiations between all parties (entrepreneurs, financial investors and suppliers) will drive the future of the relationships. The earlier the better, that the rules are set and trust built.

The supplier is usually involved very early on in the project in order to check the feasibility and cost of the system. It is at that time that the relationships begin.

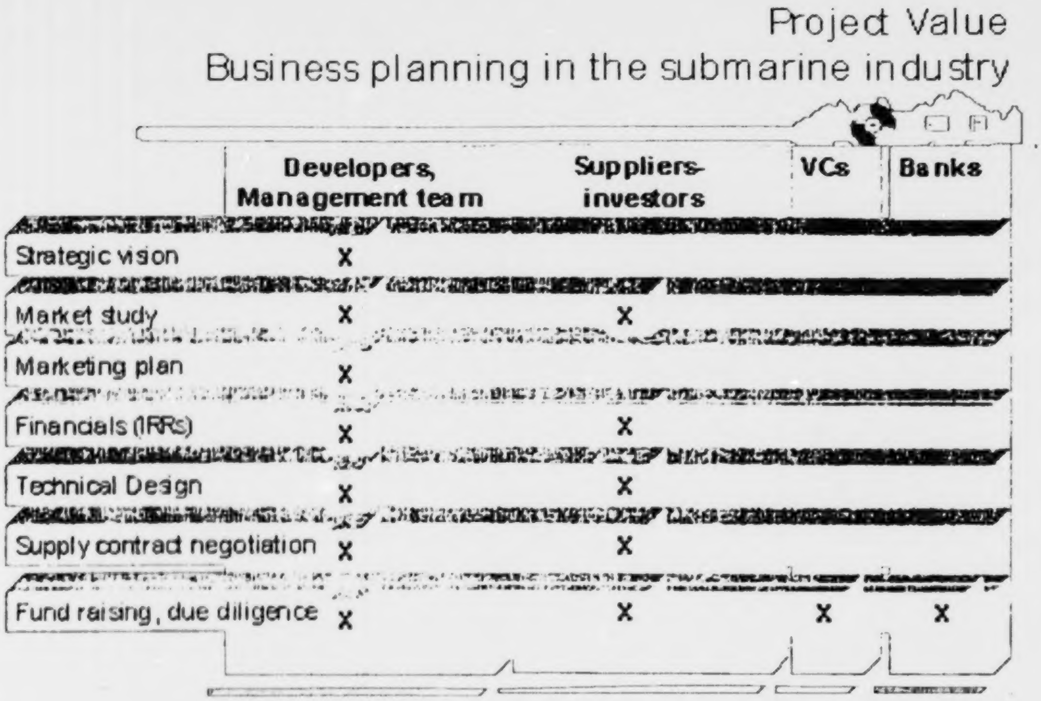
Combining the entrepreneur and supplier's expectations will be the aim of the integrated services offer.

Building the Integrated offer.

The implementation of the business plan requires quite a few activities to take place.

The activities encompass the following areas:

- Strategy, expressing the vision, the positioning of the company;
- Management, building the management team which will sell the project to the community;
- Marketing, commissioning an independent market study, elaborate the marketing mix;
- Financial, find out the financial needs, the expected returns;
- Technical, designing the system;
- Commercial, negotiate the contract as well as technological partnerships.



Project Value

Business planning in the submarine industry

	Developers, Management team	Suppliers-investors	VCs	Banks
Strategic vision	X			
Market study	X	X		
Marketing plan	X			
Financials (IRRs)	X	X		
Technical Design	X	X		
Supply contract negotiation	X	X		
Fund raising, due diligence	X	X	X	X

Building an offer including all these activities requires a deep understanding of the business, which is another barrier to entry at the supplier side, and requires a much broader skill set than the traditional one within the supplier. To answer to this market change, suppliers have to move to a service organisation as opposed to offering "technical boxes". Pro-activity is becoming an important factor of success as the timing of the project is crucial.

The following points give the kind of hurdles the development of such project will face:

- Because time-to-market is a key success factor as the competition increases, development expenses are critical (the use of the development ("seed") funds have to be carefully looked at).
- The monitoring of the market conditions in the field of capacity pricing; because the return of the project is based on expected revenues which in turn are based on price assumptions, the market needs to be continuously monitored to ensure that these assumptions remain valid or that the variations still lead to a positive return!

Understanding the customer's business is key to proposing adequate services and penetrating a customer account.

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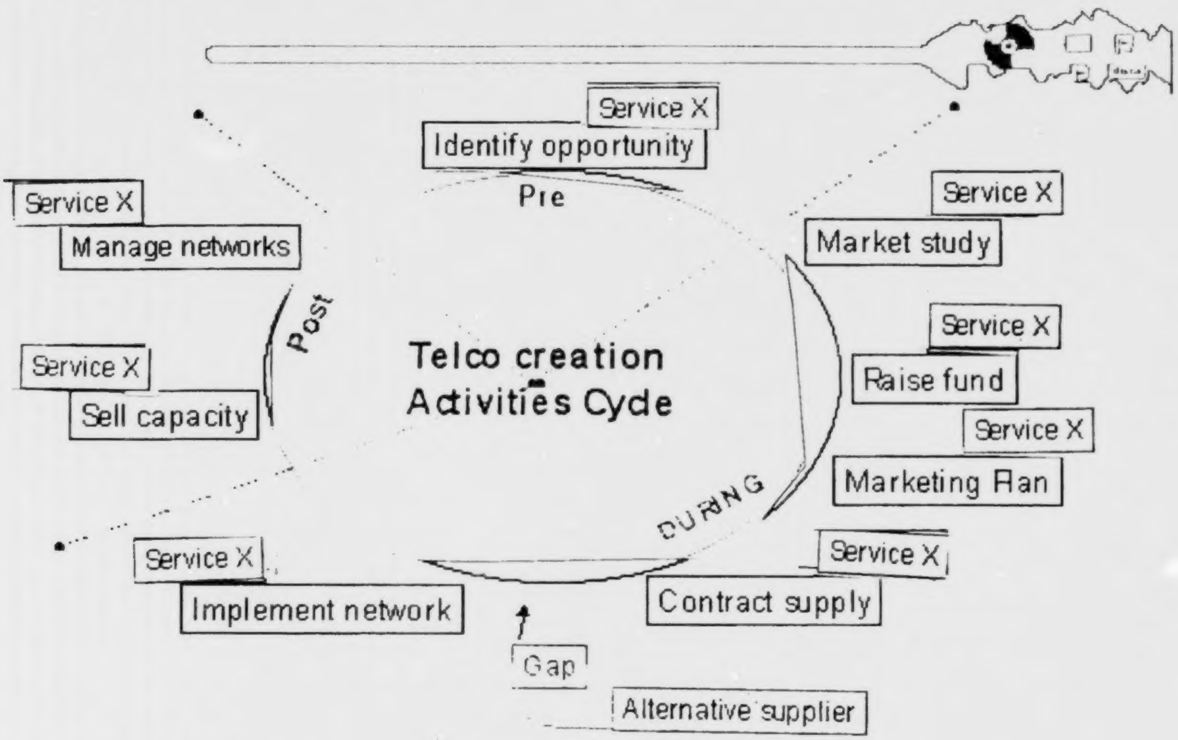
Integrated Services Framework


Service X
Identify opportunity
Pre
Service X
Market study
Service X
Raise fund
Service X
Marketing Plan
DURING
Service X
Contract supply
Gap
Alternative supplier
Service X
Implement network
Service X
Sell capacity
Post
Service X
Manage networks
Telco creation
Activities Cyde

The success of this approach(see ref.1) will come from a better shaping of customer's needs, the offering has to be "gap-less".

The integrated services experience.

In the submarine industry, new carrier's carriers must have a very strict agenda if they want to be successful. The planning activity is essential and turnkey suppliers are in a position to help them because they have an overall knowledge of what is necessary to achieve to implement such projects.

The point is to bundle this knowledge in an integrated service proposition in order to match customer's expectations in term of : Value for money, trust and timeliness.

The integrated service offer shall have a good fit, i.e. matching customer value perceived against the Operations, Marketing and People provided by these services. It's what we call "Breakthrough Services" (see ref. 2).

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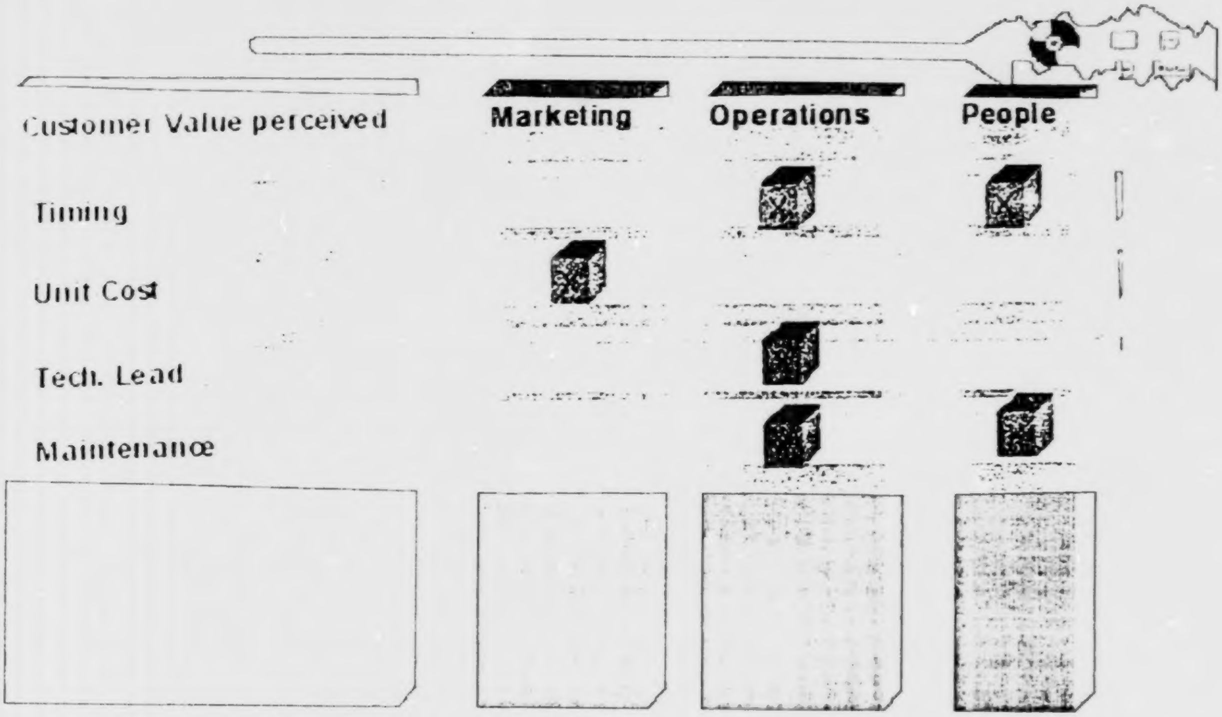
Breakthrough Services



Customer Value perceived	Marketing	Operations	People
Timing		■	■
Unit Cost	■		
Tech. Lead		■	
Maintenance		■	■

In particular, providing Business Planning services in the submarine industry is more than giving support only time-to-time, because interdependencies and competition call for a more broad and integrate approach which aims to achieve consistency and fluidity of the business activities.

Finally, this new integrated value proposition will lead to a win-win proposition as the "good fit" of these services matches the players' expectations.

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Back to top of page **Back to the sessions page**

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Back to proceeding page   **Back to the sessions page**

Internet Commerce [1] Models in Asia: Case Study on Singapore and South Korea

Brian Chin Hin Lee and Wonsuk Kang

Abstract

Introduction

Internet development in the Asia has only begun to take off after the mid-1990s, but the explosive growth of commercial activities in the cyberspace shows that "E-commerce on the Internet" is no longer an ivory-towered concept but a trend in the region. Some Asian countries, such as Singapore, Hong Kong, Malaysia, and South Korea, have put in lots of efforts in order to be ready for the quantum leap into the new era of Internet economy.

In 1998, Asia only accounted for 17 percent of the total Internet users population, where North America accounted for 57 percent, Europe accounted for 21.75 percent (NUA Analysis, 1999). However, a report of research firm International Data Corporation (IDC) (1999) indicated that Asia would enjoy the strongest growth in the number of Internet users and devices despite the economic downturn.

When it comes to e-commerce on the Internet, growth rates in the region are among the highest in the world, and often twice as high as that of America. Internet commerce has rapidly evolved as a promising economic mechanism which links the region to the global market. Geographical boundaries would no longer represent any hindrances to business transactions when Internet commerce comes to the picture (The Economist, March 1999).

As the regional hub, Singapore embraces Information Technology and promotes Internet-based e-commerce with great zeal. The Singapore government has its own information infrastructure development plans, namely Singapore ONE, as its next millennium approaches. Also, it has IT2000 Masterplan that serves as one of the promising mechanisms to make it an e-commerce hub.

South Korea is another country that has invested heavily in technology infrastructure in a bid to make the country a regional hub for the Internet. Just like Singapore, the Korean government has articulated the Informatization master plan, Cyber Korea 21, to encourage Internet adoption. In light of the rapid growth in Internet usage, IDC highlighted Korea as one of the "key areas of opportunity" in term of Internet development in Asia Pacific (The Straits Times Interactive, 1999 November 23).

However, the development of Internet commerce in Asia is somewhat different from that of the States or Europe, due to the prominent disparities in terms of economic structure, governments' roles, different cultural settings, as well as other social aspects among the Asian countries. Most of them have evolved their own Internet commerce models.

Singapore and South Korea are selected to be the subjects of this study because both countries have the similar level of economic development and Internet infrastructure, as well as comparable government's roles.

Though we don't discuss the whole spectrum of e-commerce models in Asia, it is believed that the case study on Singapore and Korea would provide useful reference and information for the international e-commerce players, Internet policy makers in the region, and the regional countries that are currently developing their own

Internet commerce frameworks.

First, we will compare the economy and Internet infrastructures of Singapore and South Korea, and use the B2B and B2C models proposed by Kang, Lee & Chua (2000) to examine the Internet commerce development of these two countries. Based on the Kang, Lee & Chua's Internet Commerce Model, we will try to explain why and how Singapore and South Korea have evolved their own Internet commerce model.

Economic Development of Singapore and South Korea

The economic development of Singapore has evolved from the labor-intensive industries in the 1960s, to manufacturing in the 1980s. Since the early 1990s, Singapore has served manufacturing and service sectors as the twin engines of economic growth (Singapore Economic Development Board, 1999).

The Singapore enjoys a pleasant growth in economy, with a GNP per capita of S$38,170 (USD23,856) and S$141.2 billion (USD88.3 billion) GDP in 1998. In 1997, its real Economic Growth rate was 8 percent. Even during the Asian economic downturn in 1998, it still grew by 1.5 percent The biggest sector in the economy pie is finance and business services, accounting for 29.2 percent of the share in nominal GDP in 1998, following by manufacturing sector at 21.9 percent. Transport and communications had a 10.5 percent share (Singapore Department of Statistics, 1999).

Prior to financial crisis of 1997, Korea's impressive growth performance was described as the economic miracle. Since the first five-year economic development plan (FYP) in 1962, Korea had been transformed from an agrarian nation into one of the fastest growing industrialized economies in the world in three decades. The results of its economic growth have been impressive [2]. Over the relevant three decades (from the early 60's to the early 90's), Korean gross national product (GNP) has grown from the equivalent of $3.2 billion to $518.2 billion, with per capita GNP soaring from $120 to about $11,664 (Handbook of Korea, 1998).

Infrastructure of Singapore and South Korea

The telecommunications infrastructure in Singapore is one of the best in the world [3]. Singapore has a fully digital network, the world's highest urban concentration of optical fiber and the world's first 100 percent ISDN availability. Besides, Singapore offers the world's lowest telecommunications charges and plans for Optical-Fiber-To-The-Home by 2005 (McCelland, 1996).

In addition, Singapore ONE is promoting its 1-Net ATM (Asynchronous Transfer Mode) backbone network, which provides ATM users with a broadband Internet access. This network has reached 98 percent of homes, all schools, 42 libraries and community centers in Singapore (Lombardo, 1999).

As at end September 1999, Singapore Cable television (SCV) had about 181,000 subscribers, a penetration rate of more than 22 percent of the Singapore households. It planned to wire up 99 percent of Singapore homes and launch its commercial cable modem service by the end of 1999 (SCV News, 1999). The cable modem allows the viewers to have access to the high-speed Internet via Singapore ONE.

Like Singapore, Korean government decided to take an initiative in information infrastructure development. The government set up the Informatization Promotion Master Plan (IPMP) in June 1996, and later it was finalized as the Cyber Korea 21 project, which embodied the specific goals for Internet development in Korea March 31, 1999 (MIC, 1999). In line with the Cyber Korea 21 project, the Korean government initiated the Korean

Information Infrastructure (KII) to serve as the structural basis for the project in 1995 [4]. The KII construction plan consists of three stages. In the first stage (1995-1997) of the plan, backbone network at 622Mbps-2.5Gbps, and the pilot ATM switching network was constructed [5]. In addition, 80 major cities across the nation was linked by fiber optical cables, connecting about 2.5 million subscribers to KII. Currently, in the second stage (1998-2002), backbone network is being upgraded up to several tens of Gbps class, and increase subscribers to 7.5 million. Finally, in the third stage (2003-2010), the nationwide use of advanced telecommunications network will be completed with 33 million subscribers (MIC, 1999).

Method

Kang, Lee, and Chua (2000) compared the nature of B2B and B2C Internet commerce using the concept explication method. According to Donohew and Palmgreen (1980), concept explication method enables researcher to examine constructs by measuring indicators. In other words, if abstract levels (constructs) are explicated down to concrete levels (indicators) logically, the indicators will be a valid representation of constructs. In their study, Kang et al (2000) found that B2B and B2C Internet commerce are developed from two distinctively different constructs in the abstract levels. They argued that B2C model creates a new production space for a new industry while B2B model links the exchanges among industries (Figure).

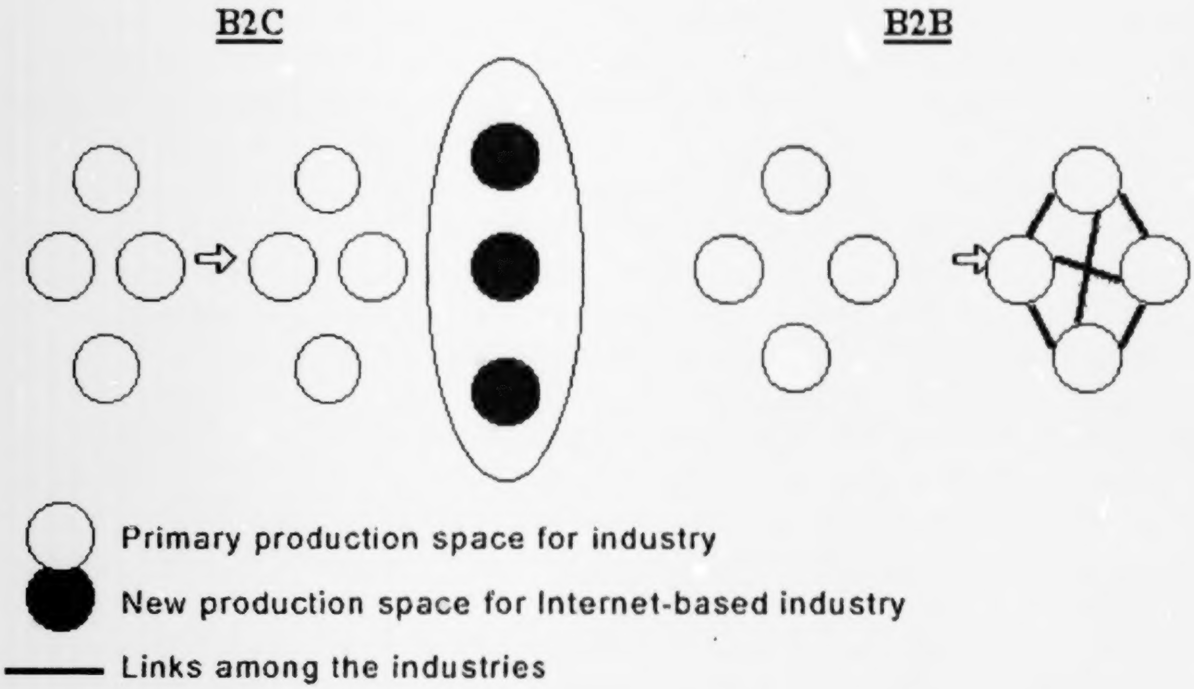
B2C
B2B
Primary production space for industry
New production space for Internet-based industry
Links among the industries

Fig. B2C vs. B2B Internet Commerce Model

The construct "production" is very much related to the Classical economic tradition, which envisioned the economy as an ongoing, self-reproducing process of production. On the other hand, the construct "exchange" borrows idea from the Walrasian paradigm, which sees the economy in the first instance as a system of exchange. The Classical economics consists of stocks of goods, which could be used either for consumption, or to reproduce themselves, whereas the owners of existing commodities seek to exchange with each other to reach more satisfactory proportions in their holdings under the Walrasian economics (Dobb, 1973; Schumpeter, 1954).

From two different approaches to Internet commerce, constructs in B2C and B2B model develop into very different.dimensions and indicators (Table). Kang et al (2000) stated that the approach to Internet commerce determines the dominant Internet commerce model by dictating the function and purpose of Internet commerce [6]. Furthermore, they argued that the engine of growth differs according to its function and purpose. Earning profits through sales in consumer oriented sector seems the most logical solution to generate or develop economy for a newly invented business. On the other hand, saving cost by restructuring in financial/logistic sector is the reasonable way to improve the current practice by increasing productivity and efficiency.

Through the concept explication of two constructs, namely "production" and "exchange," they concluded that examining the engine of growth would reveal the direction of Internet commerce of the countries.

Table. Characteristics of Internet Commerce Model

Abstract Level	Characteristics associated with Internet Commerce	B2C Internet Commerce Model	B2B Internet Commerce Model
Construct	Approach	Production	Exchange
Dimension	Function	Inventing a new business	Improving the current business
	Purpose	Generating and developing Economy	Increasing productivity/efficiency
Indicators	The Engine of Growth	Earning profit through sales in consumer-oriented sector	Saving cost by restructuring in financial/logistics sectors

However, they cautioned that this model could be limited to Asian countries with "directed capitalism" where a strong executive-centered government uses its heavy hand on economy within the capitalistic framework. Unlike the U.S. where the market decides the direction of Internet commerce by itself, Asian countries would select better approach between the two models, and plan out the follow-up policy accordingly. Their selections are demonstrated in their approaches to Internet commerce.

Using Kang, Lee and Chua's Model, this paper will examine the directions of Internet commerce in Korea and in Singapore. By examining the indicators of two countries will show the their approaches to the Internet commerce.

Internet Commerce in Singapore and Korea

With the vast penetration of the Internet in Korea, Internet commerce has taken a prominent position as a new economic activity. E--commerce in Korea grew from 55 billion won in 1998 to 150 billion won in 1999. It is expected to skyrocket to 3.78 trillion won in 2002. Over 75 percent of businesses are expected to take advantage of e-commerce in 2002 (Jung, G., 1999). Currently, the Korean E-commerce is heavily leaned toward

B2C segment of E-commerce.

In banking, 10 major banks in Korea started Internet banking as of August 1999. These banks are gathered in a virtual city called "Bank Town," offering the same services as they do in their offices except for loans (Song, 1999). While individual consumer transactions are in progress, business transactions are not offered, yet. In other financial markets, Korean securities companies started providing the cyber trading along with their conventional trading in 1998. As soon as securities companies began cyber trading services, they recorded a very rapid growth from 4.7 percent of total trading in January 1999 to 16.8 percent in June. On January 2000, two cyber trading companies--Future Asset Co., and Trade Korea Co.--were established. With cheaper transaction cost, cyber trading market is expected to continue to grow. More companies are expected to join the bandwagon (Kim, 2000).

In other area, Internet auctions are on the rise. Currently, there are 11 auction sites in Korea. The Internet Auction, Inc., the biggest Internet auctions company in Korea, has US$5 million transactions in a year with 30,000 members. About 700 bids are made every day for 35,000 merchandise items. Jaeyoon Kim, chief researcher in the Samsung Economy Research Institute said Internet auctions will lead e-commerce (Yu, 1999a).

At present, however, it is Internet shopping that is leading the Korean e-commerce market. It is also the fastest growing market in Korea. In 1998, US$25 billion won in sales were made. But in the first half of 1999, sales were US$27 million won. The number of Internet shopping malls grew from 400 in 1998 to 800 in June 1999 (Ham, 1999). Online shopping malls became so popular that even a shopping-aid web site appeared. Of the total sales, online department stores account for the largest portion of 12.5 million [7]. Specialized shopping malls are also on the rise. More than 40 bookstores went online since the first Internet bookstore, Jongro Bookstore, opened on 1 May 1997. Gyobo Bookstore, the biggest online bookstore in Korea, has about US$670 thousand sales monthly that comprise about 10 percent of the total sales of the day. Youngjo Lee, director of Gyobo, estimates that the Internet sale will reach up to 30-50 percent by 2001 ("The Internet," 1999). The consumer oriented E-commerce is growing so rapidly that some of the on-line business is making conventional business obsolete. For example, cyber travel agencies are expected to take over the market from the conventional ones with a cost-effective management and ability to customize service around the clock in partnership with hotels, airline companies and other tour services (Choe, 1999).

On the other hand, Internet commerce in Singapore takes a somewhat different direction. When it comes to Internet development, business and economics are always the major concerns of both the government and private sectors in Singapore. Helping local enterprises harness the opportunities in Internet commerce has become one of the Singapore government's top priorities for the present being.

Unlike South Korea, B2B segment of Internet commerce far outstrips B2C segment in Singapore. When it comes to promoting Internet commerce, Singapore government serves B2B segment as the backbone. Even the private sector is more active partying in the B2B Internet commerce than in the B2C segment (Chua, 1998).

Wong & Lam (1999) said that "B2B E-commerce constitutes the predominant form of transaction compared to B2C transactions, with 98% of sales being derived from B2B."

In addition, revenue derived from e-commerce supporting services soared to $272 million in 1998, up from $146 million in 1997. The e-commerce supporting services comprise mainly network services, e-commerce solutions, security services, payment services, search engines, web advertising, etc. (Wong & Lam). Although the same survey indicated that more firms are using the Internet to reach their potential customers, these services are basically targeting at the businesses instead of the end users or individual consumers.

It is believed that Internet commerce in Singapore is going to grow tremendously due to the improved technology, security and the government's push. According to IDC, the expected revenue from Internet-based e-commerce in Singapore for 1999 was about US$800 million (CommerceNet, 1999).

Most large enterprises have favorable attitudes toward the government's push because e-commerce translates into potentially big savings as they simplify and expedite the transaction process. The development of B2B Internet commerce in Singapore is therefore quite smooth. B2B e-commerce was worth $200 million in 1998 and is expected to hit $2 billion in 2001 (Chua, 1998).

In a survey conducted in January 1999 by National University of Singapore's Center For Management Of Innovation & Technopreneurship, about 9 percent of Singapore companies had involved in B2B e-commerce activities. This figure showed that Singapore companies adopted e-commerce faster than the most Internet-advanced countries such as the United States (5 percent), Ireland (5 percent) and France (4 percent) (Leong, 1999).

The study also indicated that 73 percent of Singapore companies have Internet accounts and one in three companies has its own website.

Another survey of over 1,000 companies done by NCB in mid-1999 also showed that most companies in Singapore are basically Internet-ready (Toh, 1999).

Although Singapore government always encourages SMEs to harness the power of Internet, the government-linked companies and the bigger firms are still the major parties that dominate the local e-commerce development for the present being (Toh, 1999).

Leaders in local e-commerce on the Internet are electronics, chemicals and publishing industries. The top reason companies gave for their entry into Internet commerce was the positive image and reputation associates with being in the forefront of technology (Leong, 1999).

On the contrary, B2C Internet commerce is still in its infancy in Singapore. Most online merchants in Singapore are still concentrating on providing basic information and selling products. Not many actually use the Internet to manage customer relationships or streamline their business operations. In 1998, there were about 200 online retailers in Singapore chalking up about US$5 million a year in sales and expected to top US$1 billion by 2001 (There were 400,000 retailers and estimated $10 billion in the States) (Chua, 1998).

According to an NCB survey of Internet consumers in July 1998, 25 percent of Singaporeans are keen to try Internet commerce, while there are only 6 percent had done so then (NCB, 1998).

Each government's focus on Internet commerce is quite clear. The next section will explain why each country has directed Internet commerce in certain way.

Explanations

Purpose and Function

The first explanation can be made examining whether the purpose and the function of nurturing B2C/B2B segment match the goal of future economic progress. In the summer 1997, the financial crisis that struck the economies of Thailand and Indonesia began to spread through Asia. On October 1997, Korean Stock Plunge followed by a sharp fall of the Korean Won against dollar. By November 21, Korea's foreign reserves were nearly depleted, and to prevent total collapse of the economy, the government seek for an emergency loan from the International Monetary Fund (IMF). Through a series of decisive government policy, the economy has stabilized within a year. However, economy has slowed down with two problems for Korean government. The first problem is rising unemployment rate. As a part of the structural reforms in the economy, labor market that used to be rigid and secure became flexible and contract-based. Just in nine months, unemployment rate jumped from 2.6 percent to 7.6 percent, and is expected to increase further (A Handbook of Korea, 1998). The Second problem is overall slowdown of Korean domestic economy. Since the mid-1980s, domestic market steadily started to increase as export market became tougher [8]. By mid-1990s, most major exporting products including automobile, camera, general machinery, consumer electronics, computers, semiconductor, and telecommunications equipment was relying on domestic market for 30-50 percent of their total sales (A Handbook of Korea, 1998). When economic slowed down decreased domestic demands, major industries in Korea suffered substantial losses [9]. Even after the economy stabilized, the domestic demand is still sluggish. Therefore, the E-commerce in Korea had to reflect two immediate economic concerns for Korean government. In fact, the Cyber Korea 21 which represents the government's views on E-commerce writes that Korea will use E-commerce to create new business to pull itself out of the current economic crisis and to create jobs to ease the unemployment pressure. To Korean government, the purpose and the function of B2C E-commerce is better suited for recent economic concerns in Korea.

Singapore suffered a significant loss from economic slowdown as well. In 1997, the Committee on Singapore's Competitiveness (CSC) was formed to re-examine Singapore's competitiveness in light of the external changes during the economic downturn (EDB, 1999).

The CSC concluded that, as a knowledge-based economy, Singapore is supposed to have a strong entrepreneurial base. In addition, companies operating in Singapore should be able to leverage on a cost-competitive motivated workforce. Therefore, one of the major suggestions the CSC came out was to "reduce the business costs, to help viable companies tide over the crisis..." (EDB, 1999).

Viewing from the way Singapore government faced the economic crisis and solved the problems, one can realize that the "exchange" is actually the guiding philosophy behind the economic structure. In other words, its major function is to improve the current business and economic situation, with a purpose to increase productivity and efficiency.

From the same report, the CSC recommended a $10 billion package reduction of Singapore's business costs per year. This includes reduction in total wage costs, the levy for foreign workers in the manufacturing and services sectors, factory rentals, charges for services, etc. Improving the current businesses and cutting cost were two major issues then.

Also, formation of the CSC and its recommendations reflect how Singapore emphasizes on business sector, instead of the consumer's side.

Relation to Conventional Structure

Every economy has its own characteristics. Its rate of growth, composition, consistency, and success would be different from other economies. However, most countries share a similarity: serving their existing industries as the top priority in their economic development blueprint.

Many countries have fallen into economic distress simply because development of their existing primary industries has slowed down. Many countries tend to create an effective environment that fosters the growth and prosperity of existing industries because the expansion and retention of conventional industries is proven to be very important components of economic development (Fruth, 1998).

The Internet commerce can never be created in vacuum. Its development is closely linked with the conventional industry as well. It is found that the conventional structure has its own significance when Singapore and South Korea develop their Internet commerce models.

Finance and business services is the major sector that contributes to the Singapore's GDP. In 1998, it accounted for 29.2 percent of the GDP pie, with manufacturing at 21.9 percent, commerce at 18.8 percent (MTI, 1999). When the economic crisis hit the country, one of its major solutions was to help the manufacturing and services sectors cut cost.

The Singapore EDB (1999) launched its economic blueprint for the 21st century, namely Industry 21, which aims to develop Singapore into a global hub of knowledge-driven industries. Under I 21, the manufacturing and services sectors will be developed with a strong emphasis on technology, innovation and capabilities. The blueprint encourages the local SMEs to embrace more knowledge-intensive activities, with Promising Enterprises evolving into world-class players. At the same time, it tries to attract more MNCs to anchor more of their key knowledge-intensive activities in Singapore.

The latest economic blueprint is trying to create a conducive business environment and infrastructure necessary for knowledge-driven activities among companies. Once again, it shows that Singapore government emphasizes on the B2B when it comes to the strategies to the overall economic development.

In addition, Singapore is highly open to international trade and investment. In 1998, the ratio of trade to GDP is 250 percent, with foreign investment commitments in the manufacturing sector amounted to US$3.1 billion (MTI, 1999) Singapore's regulatory system has been promoting a stable financial and banking system to attract international enterprises to conduct business in Singapore (MAS, 1999).

However, Singapore is doing relatively less on B2C when it comes to providing friendly e-commerce environment. For example, the Monetary Authority of Singapore (MAS) said it will not lower the minimum qualifying income for individual credit card application. The minimum income requirement was raised from S$24,000 (about $ 14000) to $30,000 (US$17650) per annum in 1991 (Chan, 1999). Consumer online transactions are basically credit card-based.

The recent years, Singapore has gained vision of becoming an early adopter of Information Technology (IT) and innovators of IT applications in order to remain competitive in the international arena. The government has started a major push to develop a strong local science and technology base to support both the manufacturing and business services industries (EDB, 1999). Once again, Singapore shows that it is more comfortable restructuring the conventional industry and help it take flight (EDB, 1999).

Unlike Singapore, the main structure of Korean economic structure was built for manufacturing goods and exporting them. In the 1960s, the government's focus was on building a labor-intensive industry such as Textile, Clothing and Footwear (TCF) [10]. In 1970s, Korea concentrated on the heavy and chemical industries (HCI). Korea enjoyed a steep growth at first, but start to accumulate external debt at a very rapid pace under the second oil crisis [11]. Korea Steel had external debt of approximately US$ 530 million which were equivalent to 1.4% of Korea's GNP in 1980. Korean government had to make a dramatic shift in its economic policies under the pressure of economic break down--mainly due to the trade deficit and a failure in its heavy industry orientation (Park, Hwang, and Yoon, 1997) [12].

Seeking more efficient and less energy-consuming industries, the Korean government shifted its industrial policy focus from heavy industry to consumer electronics starting 1980. By 1983, local electronic company Samsung and Goldstar started to produce VCR and color TV. About ten years later, Korea became the largest manufacturer of color television, VCR, and satellite television receivers (Larson, 1995). The policy shift changed the focus of the manufacturing industry from HCI to consumer-oriented industry. Currently, Korea's primary production is consumer goods using high and low technology. TCF, automobile, consumer electronics, computers and peripherals consists more than 60% of total exports (A Handbook of Korea, 1998).

Conclusions

In this paper, the B2B and B2C models proposed by Kang, Lee & Chua (2000) are used to examine the Internet commerce development of Singapore and South Korea, which enjoy the similar level of economic development and Internet infrastructure.

It is found that Singapore and South Korea develops two different Internet commerce models: The Internet commerce in South Korea are inclined to B2C model, whereas, Singapore, B2B model. The reasons behind it could be elaborated in terms of function and purpose. Korea economics tends to invent new businesses, as well as generate and develop economy. Meanwhile, Singapore tries to improve its current industries by increasing productivity and efficiency.

One of the important implications of this paper is that each and every country should develop its own Internet commerce model in light of its current economic development and structure. No Internet commerce model is completely applicable to all countries. What may work well for one country may fail or be inappropriate for another.

It is believed that how Singapore and South Korea developed their Internet commerce model can serve as a very useful reference for other Asian countries that were currently developing their own Internet commerce frameworks.

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Endnotes

[1] There are numerous definitions of E-commerce. Although Internet accounts for most e-commerce activities, it is not the only platform for e-commerce activities. To differentiate, the term "Internet commerce" is used in this paper, meaning "e-commerce on the Internet." Basically, the Internet commerce activities can be grouped into 2 main categories: (1) Internet commerce transactions: Business-to-business (B2B) and Business-to-consumer (B2C) transactions. (2) Internet Commerce supporting services: Network services, e-commerce package solution, security services, payment services, web advertising, etc. (Wong & Lam, 1999).

[2] The dramatic transformation of the Korean economy is particularly striking against the backdrop of the country's history. Since the era of Japan's colonial rule (1910-1945) and The Korean War (1950-1953), Korea was under extreme poverty and a rapidly expanding, largely unemployed, population until 1961.

[3] Currently, Singapore has a 45 Mbps direct Internet connection to the US Internet backbone. This will definitely increase since the major Internet Service Providers in Singapore are going to improve their connection bandwidth via satellite links. The Singapore Telecom Internet eXchange (STIX) is an Asian Internet center that connects to more than 15 countries in the Asia-Pacific Rim. Armed with 34 Mbps link via sub-marine optical fiber and satellite to the Asia Pacific region, US as well as European Internet backbone, STIX promises to provide faster and better Internet access service for Internet Service Providers and corporate users (E-Commerce Singapore, 1999).

[4] The KII has a physical national backbone network, but two conceptually different networks. One is the government network, which wires public institutions including government offices, research institutes, and universities. The other is a public network, which connects homes and offices to the government network.

[5] In order to help the general public and industry gain a better understanding of the KII, pilot projects were carried out under a two-stage plan between 1995 and 2002. In the first stage of the pilot project (1995-1997), fiber-optic cables were run to homes and offices to deliver video and information services in Taedok Science Town. In the second stage (1998-2002), distribution of the existing cable networks will be expanded to other cities (ETRI, 1997).

[6] Kang and Lee stated that the values in constructs, dimensions, and indicators are not mutually exclusive.

[7] The Lotte Department Store, nation's largest retailer and the first the Internet shipping mall, posted 1.85 billion won in revenue, a whopping 728 percent increase from previous year's 254 million. The Hyundai Department Store estimates 1.5 billion sales, while the Sinsege Department Store expects about double figure from last year's 1 billion.

[8] Since the 1960s, government has provided many export-promotion incentives such as tax exemption, tariff exemptions on materials imports used for export production, and creating funds for export industry. Also wealth accumulation through export expansion was admired and encouraged, while wealth accumulation through production activities aimed for only domestic consumption was despised. This notion began to change when exports faced barriers in 1980s.

[9] General machinery were down 12.2 %, precision industry such as camera were down 7.6%; and consumer electronics were down 5%.

[10] Although TCF (textiles, clothing and footwear) industries in manufacturing value added (MVA) declined, they are still a major activity which comprises about 24% of total exports (APEG, 1994).

[11] Starting 1980 worldwide demand for its exports began to shrink. Trade deficit reached 530 million US dollars, and for the first time, economy had negative 5.2% growth. Internally, warehouse price index (WPI) rose 42.2% and consumer price index (CPI) rose 32.2%. The worst harvest of that year forced Korea to import rice.

[12] Iron and steels that once lead the export in the 1970s now takes up less than 3% of the total exports. However, automobile filled in the place of HCI and make up about 17% of current total export.

Back to top of page **Back to the sessions page**

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Back to proceeding page   Back to the sessions page

Techniques for Financing Telecoms and Internet Infrastructure Buildout in Asia

Glenn S. Gerstell and Alisa Fiddes

Abstract

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1. INTRODUCTION

1.1 Demand for Telecom and Internet Infrastructure.

Asian markets have seen explosive growth in demand for telecommunications capacity, stemming from a range of factors, including increases in voice traffic caused by general socio-economic improvement, growth in data traffic occasioned by business growth and the existence of new applications, and of course the Internet phenomenon. All available evidence suggests that this demand will continue to grow, putting increased pressure on the infrastructure market to provide this region with robust platforms for Internet and telecom services. This mounting demand can only be fulfilled through the buildout of capital intensive infrastructure projects. Funding for such projects, however, is not always readily available, especially in emerging markets, where the elevated risk associated with projects being implemented in less developed countries discourages the participation of commercial lenders. Even for projects being implemented in developed markets, like Japan, Australia and Hong Kong, advanced economies translate into an even more pressing demand for infrastructure development and, in turn, a demand for capital that exceeds the capacity available from commercial lenders or other traditional financing methods. Creative financing solutions are therefore critical if infrastructure development in Asia is to keep pace with demand.

1.2 Approaches to Raising Capital.

This paper examines several approaches to raising capital for infrastructure development in emerging markets. Specifically, the paper provides an overview of several financing methods and sources, including vendor finance, project finance, the commercial bank market, the capital markets and strategic partnering. The paper examines the significant issues encountered in each approach and also discusses the benefits of combining these approaches to maximize access to capital while retaining the operational flexibility so critical to an industry where markets and strategies change overnight and the

2. OVERVIEW OF FINANCING TECHNIQUES

2.1 Early Stages of Development.

When a company is in the early stages of development, its financing options are usually limited to private equity, typically from "angel financiers" or venture capitalists. As a general rule, these equity investors will invest in preferred stock that is convertible to common shares, often in amounts up to 25% of the company's equity. When the company is ready to start its next phase of development, which is often the initial build-out phase, it generally looks for financing from institutional funds. These funds generally make investments in the range of $5-$20 million in exchange for convertible preferred stock, and if the investmént is sufficiently large, a seat on the company's board of directors. If a company cannot access enough venture or institutional equity capital, then the company might instead look for a local partner or other strategic partner to provide the necessary additional capital, an approach discussed later in this paper. Whether a company uses one or a combination of these approaches, its goal in the early states of development is to amass enough equity capital to get off of the ground and eventually obtain debt financing.

2.2 Development and Increased Leverage.

At some point in a company's development, it will want to increase its leverage and obtain debt financing. The universal reason is of course the shareholders' desire to increase the rate of return on their investment by "leveraging" their investment with debt. But other reasons for the use of debt will vary from one project to another and may include: the company's lack of sufficient equity to finance further development (whether attributable to the financial disparity among a project's sponsors, or to the amount of equity required being in excess of institutional investors' appetites), or perhaps a company's eagerness to obtain interest deductions from income taxes (assuming the startup is expecting to earn a profit soon). A company must first decide what kind of debt is most appropriate for its current needs. In a telecom or Internet company, where equipment and infrastructure are significant elements of its business plan, vendor financing is often the most attractive form of early financing.

2.3 Vendor Financing.

Vendor financing has evolved over recent years to become a very attractive source of early, but relatively sophisticated, financing for many start-up companies.

(a) General Overview.

Equipment suppliers historically have offered limited financing options (e.g., short installment plans) to their purchasers. Recent changes in the telecom and Internet industries, however, have broadened the types of financing options offered by vendors.

The wave of privatization in the telecom industry and the general proliferation of startup companies have engendered unprecedented demands for capital. These start-up companies often cannot obtain commercial bank financing due to their limited capital resources and credit history. The equipment vendors have responded to these demands in a variety of ways. Most significantly, rapid development of technologies within the telecom industry has increased competition among equipment suppliers. In order to remain competitive, equipment suppliers have begun to offer increasingly sophisticated vendor financing to attract more customers and are being forced to make financing a critical part of their marketing package. The pressure to enter into financing relationships with purchasers of their equipment is so great that major vendors are now a distinct disadvantage if they are not willing to provide financing. Accordingly, major vendors are leveraging their cashflow balance sheets to provide financing for current equipment sales and to cement relationships with growing telecom and Internet companies, who will provide additional sales in the future.

(b) Issues in Using Vendor Financing.

More than money. Vendors can offer advice and support that other lenders cannot. Because they understand and support the communications market, they look at a company's risk profile differently from other lenders.

Initial Pricing. As a starting point, a company will generally seek subsidized interest rates and pricing on its vendor financing, recognizing that vendors will sometimes offer below-market financing to capture a sale. It is not uncommon in such cases for vendors to "top up" or supplement the pricing upon subsequent assignment of the loan to banks or institutional investors, perhaps through a side arrangement. Even in cases where vendors successfully demand full-market pricing (in terms of up-front fees, ongoing commitment fees, and interest rate spreads over LIBOR) as a condition of their financing, vendor financing is still relatively attractive, with interest rates as low as LIBOR plus 3-4%.

Term, Refinancing and Changed Market Conditions. Ideally, just before a supply contract is signed, a vendor will arrange for "take out" financing to step in for its financing obligations. The two- to four-year equipment installation schedule on a typical project is generally inconsistent with the maximum one-year "availability periods" now seen in the Asian market for non-project finance commercial borrowings. If a company were forced by such a short availability period to borrow all of the funds before needed to pay project invoices, the company would be burdened by the negative arbitrage of overborrowing. Given this significant economic detriment, the company will demand longer availability periods from its vendors. From the vendor's point of view, a long availability period might mean that the vendor cannot syndicate the facility until the vendor's loan has been fully funded or until a much shorter availability period remains. The long availability period also means that the vendor faces higher risk due to changing circumstances. In this situation, when loans are deferred and market conditions change, disputes can arise as to who should be responsible for any required changes in interest rates, fees or terms that the bank market demands at the time of syndication of the vendor's loans. This issue is addressed in a variety of ways. In some cases a vendor will extend only a bridge loan for two or three years, and place the risk of changing market conditions squarely on the borrower's shoulders via material adverse change and "market out" provisions. In other situations the vendor will offer a long term facility, but insist that if, for example, a refinancing with high-yield debt becomes possible, the borrower must first prepay the vendor's loan on specified terms.

Coordination of Commercial and Financing Agreement. Critical to a successful vendor financing is the careful coordination of the commercial and financing agreements. First, the payment terms under the supply agreements must match the drawdown schedule under the financing agreement. In addition, it is important to consider the permitted uses of the proceeds drawn under the vendor financing-will they be used for any purpose other than the purchase of the vendors equipment, and in that regard, will they be available to pay import duties and taxes? Finally, the parties must agree on how the vendor's failure to perform under the commercial agreements affects the borrower's obligations under the financing agreements. These issues are often heavily negotiated and must be

2.4 Commercial Bank Market.

While vendors typically seek to syndicate their vendor loans into the commercial bank market, it is not uncommon for telecom and Internet companies to seek commercial bank financing directly.

General Overview.

Traditionally, infrastructure projects have been financed in the commercial bank market via secured or unsecured loans in the form of construction, term, bridge financing or working capital loans. The commercial bank market, however, has greatly constricted following the Asian and Russian financial crises in the late '90s. Banks now tend to offer quite short tenors and have strong country risk limits. In addition, commercial banks generally do not want to provide loans without a highly reliable source of cash flow. For these reasons, the availability of commercial bank financing has been inadequate to meet market demands, especially in the telecom and Internet sectors. Nevertheless, when available, commercial bank financing has significant benefits.

Benefits of Commercial Bank Financing.

Experience. First, commercial banks have substantial experience in cross-border financings, in part because they have the funding flexibility to manage construction drawdown schedules and multicurrency borrowings. This experience gives banks the capacity to understand and appraise the credit risk exposures involved in unusual loan transactions.

Flexibility During Construction Phase. Generally, commercial bank lenders are equipped to deal with unanticipated issues and are closely involved during project construction. In addition, commercial bank loan covenants and events of default are designed to allow lenders to work with the company in resolving early financial and operational difficulties by granting consents and waivers as necessary.

Bridge Financing. The availability from commercial lenders of bridge financing (or short term financing) allows developers to overcome initial hurdles due to uncertainty of cost variables, network design and revenue projections during the rollout phase. Once the market risks of investment in a project become more predictable, developers can turn to more permanent types of financing.

2.5 Project Finance.

As previously discussed, commercial bank financing generally requires that a company have an operating history and a certain source of cashflow. If a project is in the construction phase, banks are less likely to provide debt via ordinary commercial loans, but might be prepared to finance the project on a "project finance" basis if the technology risk is acceptable.

(a) General Overview.

Project finance, also known as "limited" or "non-recourse" finance, generally involves the establishment of a special purpose finance vehicle to develop, finance, construct and operate a specific project. The lenders in a project financing look to the cash flow generated by the project as the source of funds for repayment of their loans and to the assets of the project as collateral for the loans (rather than to recourse from the shareholders of the company).

In order to obtain project financing, a project must show that it will generate sufficient cash flow to meet operating expenses, debt service, taxes and other costs and deliver an adequate return on equity for the project sponsors. This assessment fundamentally involves a review of the risks inherent in the project (such as construction and completion, operating, marketing, technology, currency, expropriation and regulatory risks) and the allocation, management and mitigation of such risks through the project's contractual structure.

Unlike, for example, a project financing of a power project, telecom projects do not tend to be based around a single asset, generating a single predictable revenue stream over a definite period. The dynamic nature of the telecoms industry - a function of customer demand, technological advances and regulatory changes - all require that a telecoms project be supple enough to react quickly to market forces, including through the addition of new businesses or services. Thus, in some circumstances there is conflict between traditional project finance requirements, which use a static business and quantifiable risks as a model, and the need of a company to operate and manage its business in the ever-changing telecom and Internet markets.

(b) Issues in Using Project Finance Techniques.

Financial Leverage. Project finance is particularly attractive in capital intensive industries, such as the telecom and Internet industries, as it often allows the use of greater financial leverage than if the financing had been based on the corporate credit of the sponsors (the availability of which could be a function of the sponsor with the poorest credit profile). In addition, it may permit the sponsors to achieve off-balance sheet accounting treatment of the project's debt.

Unpredictability of Revenue. The viability of project finance techniques has traditionally been closely related to the predictability and consistency of a project's revenue stream. Telecom and Internet revenues, however, are often largely determined by market forces such as subscriber base, subscriber usage and the relevant tariff structure and may involve a higher collection. Price competition from existing and new market entrants can also drive down a project's revenue from projected levels. With fewer long-term revenue-generating contracts being executed, equity investors and lenders are clearly exposed to commercial and market risk.

Regulatory Risks. In the'90s, the revenue analysis of telecom projects was frequently been based on the company holding an exclusive license or concession arrangement within a particular geographical area or time frame. Telecom technologies and markets are evolving so rapidly, however, that the exclusivity, duration and utility of such arrangements is now much less likely to be assured for their full term, leaving investors exposed to new market risks. In addition, the rapid growth in telecom and Internet technologies has outpaced the regulatory landscape, increasing uncertainty about future regulation.

2.6 Export Credit Agency Financing.

Infrastructure projects in emerging markets often involve political risks that can impair a project's access to financing. Where such a project involves the sale of goods and/or services from its country of origin to a foreign market, however, the project may be eligible for coverage by export credit agencies ("ECAs"). Where the export content is insufficient, or the political risks are significant, multilateral credit agency ("MCA") coverage may be available. The willingness of ECAs and MCAs to participate in projects provides significant encouragement to, and is often a necessary prerequisite for, lenders and investors interested in participating in emerging market projects.

2.7 Capital Markets.

The capital markets are often an attractive alternative for companies and projects seeking leveraged financing and can be accessed in a number of different ways to provide financing for a telecom or Internet project. A project company may choose to issue capital markets debt securities (bonds), or issue equity securities (stock) in an IPO, if the markets are robust enough that investors will take the speculative risk on it's the project's technology and cashflow.

(a) General Overview.

Traditionally, underwriters have not wanted to take the "open ended" market and construction risks associated with a start-up telecom project unless backed by a commercial bank guarantee or some other form of credit enhancement. In recent years, however, capital markets participants have become increasingly familiar with project financing techniques, rating agencies have been willing to rate securities issued to finance infrastructure projects, and the US and international capital markets have consequently become an important source of financing for telecom and Internet projects.

Accordingly, the capital markets are now being used both by companies with an established revenue stream, as well as (at least when market conditions permit) by those who are cash starved and lack the corporate history to attract traditional financing or launch an IPO, but who can exploit the high-yield debt market's (somewhat fickle) appetite for non-investment-grade emerging market telecom projects.

(b) Issues in Using Capital Markets.

Timing. Large amounts of debt can be raised in a short period of time by relying on exemptions in the US and European securities laws (such as Rule 144A) that permit direct sales to institutional investors without a formal regulatory registration process or listing on a stock exchange.

Broader Pool of Investors. The bond market can provide a broader pool of investors than the traditional bank and ECA markets. The growing investment requirements of insurance companies and pension and mutual funds have created a significant pool of capital seeking long-term, fixed income assets.

Project Economics. A company can more closely match the anticipated life of a project's cashflow using the longer tenors typically available in the bond markets. Fixed interest rates and the competitive all-in pricing of bond financing also attract sponsors, although high-yield debt offerings typically bear a higher rate of interest than syndicated bank facilities.

Security and Ranking. High yield securities are usually unsecured and typically rank junior to an issuer's senior bank debt, either structurally (by being issued by a holding company above the operating company) or via contract. A bank loan to the same company, however, would probably be secured by collateral security or have shareholder guarantees.

Looser Covenants and Terms. The covenant package for a bond transaction (including project finance bonds) will generally be smaller than for syndicated bank loans and with lower thresholds (including for financial ratios), to provide a greater "cushion" to avoid defaults by the company. This need for a cushion is necessitated by a number of factors, including: (i) the practical difficulty for the trustee acting on behalf of the bondholders to obtain sufficient consensus for waivers or amendments from the bondholders; (ii) the limited discretionary authority of the trustee; and (iii) the bond investors' lack of exposure to sophisticated telecom and infrastructure projects and continuing company contact to make necessary decisions.

Uncertainty. The high yield process, although sometimes more timely than a syndicated bank financing, is inherently less certain. Once an issuer brings its deal to the market, investors are free to buy the debt or not. Realistically, the issuer has little ability to change the covenant terms and can only adjust the pricing. In addition, the absence of a firm financing commitment by an underwriter up until the time a bond offering is actually priced can be a source of significant uncertainty.

Negative Arbitrage. Capital markets debt is generally funded in a single issuance and deposited into an escrow account until required to fund project costs. Where a project has a long construction period, the interest accrued on the bonds is unlikely to be fully offset by the earnings on the outstanding balances in the escrow account. Accordingly, capital markets debt is probably most efficiently used when outstanding project costs are significant or when it is being used to refinance other debt.

2.8 Strategic Partnering.

Start-up companies can nearly always benefit from establishing one or more strategic partnerships, whether to obtain a local partner, a major industry player, management expertise, new technology or to maximize efficiency. While the strategic partnership offers any number of practical benefits (usually with fewer resources and greater flexibility than traditional acquisitions), the strategic partnership can also serve as an effective financing tool.

(a) General Overview.

Many telecom and Internet projects favor joint ventures for their financing needs, seeing exposure to world stock markets and IPOs as too risky and often of limited availability. The joint venture concept can be used as a funding tool on many levels. Partners might choose to make direct cash contributions or instead to make non-cash contributions that obviate the need for additional financing. In addition, a joint venture consisting of one or more major industry names is more likely to be able to take advantage of a variety of financing options.

(b) Issues in Using Strategic Partnerships.

Reduction of Risk. Because of the complexity of telecom and Internet projects, strategic alliances can reduce project risks by bringing together partners with complementary resources and expertise. By pooling capital resources, political connections, technical, financial and marketing expertise and brand name recognition, project risks can be spread among the strategic partners.

Expertise. Whether an international telecom operator or an emerging markets local telecom operator, such a company as a strategic partner can bring critical expertise, a factor that enhances the company's ability to win a concession or license, given that securing a license and implementing a system will largely depend on the experience and aptitude of its management team.

Intellectual Property. Intellectual property is a key concern for strategic partnerships. A number of issues must be addressed, including how to value intellectual property contributions and whether such contributions take the form of a license or a grant. In addition, consideration must be given to the eventual distribution of IP rights at the termination or dissolution of a joint venture.

3. COMBINING FINANCING TECHNIQUES

In the past, companies tended to rely on a single type of financing for a particular purpose (e.g., project finance for construction of major infrastructure projects and capital markets for refinancing the debt once construction was complete). As the telecom and Internet markets continue to develop, it is clear that no single source can or necessarily should serve all of a telecom or Internet start-up company's financing needs. First, because of the capital intensive nature of these projects, no one source of financing is generally available - a variety of sources must be pulled together to amass the amount of capital required to develop such projects. In addition, the evolving nature of these projects in the early stages translates into uncertainty in many areas -- the technology, the business plan and the financing needs. With so many moving targets, it is nearly impossible and almost certainly undesirable to "lock into" a single financing arrangement that is likely to impose a multitude of limitations on a company that, by definition, requires flexibility to grow. By using a number of sources of financing, a company is able to maximize its flexibility and, with luck, minimize the total costs of raising capital. Multi-source financing enables companies to engage leading banks, institutional investors, ECAs and other industry players not only to raise funds but also to combine expertise, experience and technology to ensure an optimal environment for growth of a particular project.

Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Program

Social / Cultural

Tuesday, 16 January 2001
1100–1230

T.2.1 Going Digital in Developing Countries

Location: South Pacific I / II

Chair: RYOTA ONO, Associate Professor, Aichi University, *Japan*

Panelists:

Going Digital in Developing Regions and Countries

NESTOR CRISCIO, Chairman, Technical Committee, International Association of Broadcasting, *Uruguay*

Going Digital Television in Mexico

ROBERTO PINEDA, Chief, New Technology Projects, Televisa, *Mexico*

Analog Switch-Off: Spectrum Auctions in the Digital Age (ABSTRACT)
(moved from T.1.5 – Digital TV Regulation)

ANDREAS GRÜNWALD, Research Fellow, Institute for Information, Telecommunications & Media Law, University of Münster, *Germany*

"Sorting Out the Bits" Digital Television and Datacasting in Australia–A Study in Policy and Regulatory Development (ABSTRACT)
(moved from T.1.5 – Digital TV Regulation)

JANE FORSTER, Partner and CAROLINE LOVELL, Senior Associate, Communications Legal

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Back to proceeding page **Back to the sessions page**

"Sorting out the bits" Digital television and datacasting in Australia A study in policy and regulatory development

Jane Forster and Caroline Lovell

Abstract

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Introduction

Over the last two years Australia has engaged in an extraordinarily complex process to develop arrangements for conversion from analog to digital television. The process has involved almost a complete revision of what broadcasting means in Australia and has resulted in regulatory arrangements and concepts unique to Australia. It remains to be seen whether the arrangements will be successful or unworkable because they are too complex.

Our prediction is that the arrangements will prove to be unworkable. Significantly, the arrangements do not deal with the various new concepts or elements in a consistent manner. For example, distinctions between broadcasting and datacasting are based on content or genre. The same basis is used to distinguish between enhanced services and multi-channelling (together with considerations of timing and location). On the other hand, webcasting has been distinguished from broadcasting by reference to its means of delivery.

Background - The 1998 Framework

In mid 1998, the Australian government passed legislation containing the basic framework for the conversion of free-to-air (FTA) television broadcasting services from analog to digital mode.[1] The major features of the framework are as follows:

- the existing commercial broadcasters and the national broadcasters (the ABC and SBS) are each to be allocated an additional television channel so that they can begin transmitting digital terrestrial television services. New transmitter licences are to be issued for digital television broadcasts free of charge, in recognition of the high initial conversion costs that existing broadcasters will have to meet.[2]

- a moratorium on the issuing of any new commercial television broadcasting licences before 31 December 2006, again, in order to give existing broadcasters a degree of certainty in recognition of the high conversion costs they will have to meet.[3]

- existing broadcasters will have to simulcast their programs in both a new digital channel and their current analog channel for at least eight years from 1 January 2001. At the end of this simulcast period, the analog spectrum will be returned to the government and it may be allocated for other purposes.

- commercial broadcasters are not to provide subscription television services, but will be permitted to use the multi-channel capacity of digital transmission to transmit an additional program in digital mode, if the additional program is incidental or directly linked to a simulcast program.

- the Australian Broadcasting Authority (ABA) is to identify unused spectrum not needed for the conversion process which will be made available to "datacasters" for datacasting services on a competitive basis. This spectrum will not be made available to Pay TV operators and, although existing broadcasters (both commercial and national) will be permitted to datacast using any excess transmission capacity in the digital channels they are allocated for simulcasting, they will pay a charge for doing so and will not be permitted to apply for the unused spectrum identified by the ABA.

- digital broadcasts are to commence on 1 January 2001 in both metropolitan and regional areas (with test transmissions to be made in digital mode before then). All areas are to have digital services by 1 January 2004. High Definition Television (HDTV) was mandated on the basis that regulations would prescribe the format(s) and technical standards and quotas.

"Broadcasting service" is defined by section 6 of the *Broadcasting Services Act 1992* (BSA) in a technology neutral fashion as:

> "...*a service that delivers television programs or radio programs to persons having equipment appropriate for*

> *receiving that service, whether the delivery uses the radiofrequency spectrum, cable, optical fibre, satellite or any other means or a combination of those means...."*[4]

"Datacasting" is a new concept that is unique to Australia's approach to digital television.[5] A "datacasting service" was defined in the 1998 legislation as:

> *"...a service (other than a broadcasting service) that delivers information (whether in the form of data, text, speech, images or in any other form) to persons having equipment appropriate for receiving that information, where the delivery of the service uses the broadcasting services bands".*

All that was really clear from this definition was that "datacasting" was something other than broadcasting which used the broadcasting services bands (radiofrequency spectrum) as its delivery method.

The term "multi-channelling" and the condition that it consist of "programs incidental and directly linked" to simulcast programs (or enhanced services) were not explained in the legislation.

The legislation required the Minister for Communications, Information Technology and the Arts (the Minister) to conduct reviews into a myriad of matters before 1 January 2001, including into the following:[6]

- whether any legislative amendments should be made in order to deal with convergence between broadcasting services and other services;
- the scope of datacasting services and enhanced services;
- whether, and to what extent, the national broadcasters should be permitted to multi-channel and, if so, whether legislative amendments would be required to enable them to do so; and
- HDTV format standards.

The distinctions between broadcasting, datacasting, multi-channelling and enhanced services were intended to be fleshed out during the review process. However, the government's policy parameters were clear- datacasters were not to be permitted to become de facto commercial broadcasters (at least not before 1 January 2007) and enhanced services were not to involve de facto datacasting.

December 1999 - Tabling of Review Reports and Policy Decisions

On 21 December 1999, the Minister issued a document containing the policy decisions reached by the government as a result of the above reviews.[7] In addition, a three-volume set of reports on the reviews was tabled in Parliament.[8] In summary, the decisions were as follows:

> 1. new content or genre based definition of datacasting would be introduced. Datacasters would not to be permitted to provide "traditional television programs".[9]
>
> 2. the national broadcasters would not to be permitted to multi-channel due to "legitimate concerns" that this would involve unfair competition with Pay TV operators.[10]
>
> 3. FTA broadcasters would be permitted to provide enhancements to their simulcast programs, provided the enhanced services were directly linked to and contemporaneous with the main program. Limited multi-channelling would be permitted for "overlaps", eg to allow transmission of the end of a sporting match if it runs over time at the same time as the next scheduled program. Enhanced programming in the form of live coverage of a different sporting event to that being broadcast as the primary program would be permitted, provided both events were being played at the same venue, in the same sport and there was an overlap in time between them.[11]
>
> 4. FTA broadcasters would be required to provide a Standard Definition Television (SDTV) signal at all times. Quotas for HDTV transmission were also selected. Commercial broadcasters would be required to provide at least 20 hours of HDTV programs within 2 years of the commencement of digital transmissions in each area.[12] This would involve a "triplecast" during the time the HDTV quota was being fulfilled (ie in analog, HDTV and SDTV).

Consideration of the Review Process

For each of the reviews, the Department of Communications, Information Technology and the Arts (DOCITA) released an extensive Issues Paper inviting submissions from interested parties. After receipt and consideration of the submissions provided, an Options Paper was produced, followed, ultimately, by the final report. Not surprisingly, the submissions received by DOCITA were generally predictable and clearly driven by self interest.

In relation to the scope of datacasting services, for example, the potential datacasters (which include Fairfax Holdings, News Limited, Ozemail, Telstra and AOL Bertelsmann On-Line Services) argued that datacasting should be defined as widely as possible. There appears to have been general acceptance, that the distinction between broadcasting and datacasting should remain, and that one or other concept should be redefined in order to clarify the distinction. AOL Bertelsmann On-Line Services (a joint venture between AOL and Bertelsmann AG) submitted that broadcasting should be redefined.[13] News Limited submitted that the distinction should be based on whether it is the bit stream originator or the customer who has control over the timing of participating in the multimedia experience at the reception device and that there is an essential "experiential difference" between datacasting and broadcasting.[14]

By contrast, Cable & Wireless Optus (in its capacity as a Pay TV operator) submitted that the definition of datacasting should be restricted so as to exclude services that are de facto broadcasting services (such as video on demand, near video on demand, cached/stored video and audio services) which could be exploited by the existing FTA broadcasters to "entrench their dominant position in the electronic communications market".[15]

The Pay TV operators also strenuously opposed the granting of generous multi-channelling rights to the FTA broadcasts. The FTA broadcasters were naturally keen to see the most expansive possible approach to enhanced services, while potential new datacasters such as Telstra submitted that the FTA broadcasters will have a market advantage because they can use spectrum allocated to them for simulcasting during the conversion process for the provision of enhanced services.[16]

The 2000 Amending Legislation

The government introduced the *Broadcasting Services Amendment (Digital Television and Datacasting) Bill 2000* and the *Datacasting Charge (Imposition) Amendment Bill 2000* into Parliament on 10 May 2000 (collectively referred to as the 2000 legislation). Not surprisingly, the passage of the legislation was controversial. The government insisted that the legislation be dealt with before Parliament rose for the winter break on 30 June 2000 so that digital transmissions could still commence on 1 January 2001. The opposition and the Democrats accused the government of leaving insufficient time for consideration and debate.[17] In truth, though, the positions of the various stakeholders had been fairly clear for a considerable period.[18]

Throughout the parliamentary process, intense lobbying by stakeholders, particularly by potential datacasters and the FTA commercial broadcasters continued.[19]

Each of the major minority parties tried unsuccessfully to introduced substantially revised regulatory arrangements for datacasting during the consideration of the 2000 legislation by the Senate in Committee. The Democrats proposed an approach where datacasting would simply not be or include broadcasting services or provide access to stored video programming which would function substantially as broadcasting services.[20] Labour proposed that a datacasting service be one with the following attributes:

- it uses the broadcasting services bands;
- it is interactive;
- it is non-contemporaneous;
- it is non-linear;
- it offers frequent user-defined choices;
- it makes frequent use of static graphic interfaces;
- it complies with any determinations or clarifications to be made by the ABA.[21]

The debate about datacasting led to some rather extraordinary statements by the Minister in relation to broadcasting. At the same time as trying to draw a policy-based distinction between datacasting and television broadcasting, the Minister said that "It has now reached a point where definitions of broadcasting are not of any great assistance in interpreting which is meant by datacasting" and that "...the meaning of the term 'broadcasting services' is quite uncertain in this day and age".[22]

When the review/consultation process and the amending legislation are analysed systematically, it becomes clear that the changes achieved by stakeholders as a result of participating in the review process were minimal. While it perhaps goes too far to say that the outcome of the reviews was always a foregone conclusion, the government's declared policy objective of protecting the interests of the incumbent commercial FTA broadcasters did not leave the government very much room to manoeuvre, particularly on the issue of datacasting.[23] Nevertheless, it took the government an unexpectedly long time (from December 1999 to early May 2000) to prepare amending legislation to effect the decisions made as a result of the review/consultation process, which may indicate that there was something of a struggle with some of the more complex issues.

The major changes achieved by the review process seem to have been the "must carry" requirement for SDTV[24] and a slight expansion (or at least clarification) of the concept of enhanced services. Although the government's general approach to datacasting has not changed, the way in which it has been defined creates considerable uncertainty.

Datacasting

Defining datacasting services and the regulatory arrangements for such services have proved to be the most contentious aspect of the digital conversion process in Australia. During the course of the Reviews on the Scope of Datacasting Services and of Enhanced Services, DOCITA identified three, not necessarily mutually exclusive, means of distinguishing between datacasting and broadcasting: [25]

1. the appearance and nature of the transmitted material - whether or not the relevant services have the appearance of television;

2. whether or not the service is interactive (the type of approach advocated by News Limited, see above);

3. whether or not the service is provided on a subscription basis.

The government opted for a complex content or genre based model.[26] First, the definition of "datacasting service" was changed slightly from the version in the 1998 legislation so that it now means:

> "*...a service that delivers content:*
> *(a) whether in the form of text; or*
> *(b) whether in the form of data; or*
> *(c) whether in the form of speech, music or other sounds; or*
> *(d) whether in the form of visual images (animated or otherwise); or*
> *(e) whether in any other form; or*
> *(f) whether in a combination of forms;*
> *to persons having equipment appropriate for receiving that content, whether the delivery of the service uses the broadcasting services bands*".

A person providing a datacasting service will be a "datacasting service provider" and must hold a datacasting (content) licence to be issued by the ABA. Datacasting content is subject to restrictions (licence conditions) "designed to encourage datacasting licensees to provide a range of innovative services that are different to traditional broadcasting services".[27] The types of content or programs regarded as content genres traditionally considered to be FTA television have been divided into two categories (A and B). Category A programs are: drama, sports, music, infotainment or lifestyle programs, documentaries, reality television, childrens' entertainment, light entertainment or variety, compilations, quiz or games programs, comedy programs or any combination of these types of programs. Category A programs do not include information-only or educational programs. Category B programs are: news or current affairs, financial, market or business information bulletins, or bulletins or programs that consist of a combination of these types of programs. Category B programs do not include information-only or educational programs or foreign-language news bulletins.

Datacasting licensees may not provide Category A programs, except short extracts of up to 10 minutes in length. Extracts may not be combined to constitute Category A programs. Licensees may not provide Category B programs, except short extracts of up to 10 minutes in length. Again, extracts may not be combined to constitute Category B programs. Extracts of Category B programs may not be changed, eg updated, more frequently than every half hour. However, licensees may transmit a bulletin or program (of a Category B nature) provided it:

a. is not presenter-based; and

b. is either made up of only one item of news, or a compilation of items less than 10 minutes in length and of the same or directly related subject matter, or a weatherbulletinor program; and

c. can only be accessed by an end-user who makes a selection from an on-screen menu.

Similar distinctions are drawn in relation to audio content to prevent datacasting licensees engaging in radio broadcasting.

Datacasting licensees may provide the following types of content: information-only programs (including those enabling people to carry out transactions), educational programs, interactive computer games, content in the form of text or still visual images, Parliamentary broadcasts, "ordinary electronic mail" and Internet content.

The ABA is given powers to enforce the distinctions between broadcasting and datacasting, including, if necessary, a power to make written determinations as to whether or not content falls within a particular genre, for example, because a datacasting licensee is unsure.

Datacasters will also be required to hold transmitter licences to be issued by the Australian Communications Authority (ACA) to use radiofrequency spectrum. These licences will be issued for an initial term of 10 years with a single renewal of 5 years.[28] From 1 January 2007 when the moratorium on new commercial broadcasting licences comes to an end, these licences could be converted into FTA television broadcasting licences.[29]

The government's approach to datacasting can most favourably be described as complex! It has been called, with some justification, "dull but worthy".[30] It also gives rise to some perhaps unintended but nevertheless absurd results. For example, permissible datacasting content must be educational but may not be entertaining. Surely educational content needs to be entertaining in the sense of being engaging in order to be of interest.[31] Similarly the line between enhanced services and multi-channelling is likely to be difficult to identify in practice.

Convergence

That part of the government's report on the reviews dealing with convergence issues (volume 3) is somewhat unusual. Despite the terms of the review, the report is not restricted to convergence between telecommunications, information technology, broadcasting and other forms of media, but purports to be an outline of a framework for the government to address the impacts of "structural" convergence on policy formulation generally. Without any real analysis of the regulatory arrangements relating to broadcasting and telecommunications, the report concludes that regulatory arrangements for communications generally will "remain sound" for some time although there is some ambiguity in the split of responsibility for spectrum management between the ABA and the ACA.[32] The government's review on convergence forms an interesting background to the events that subsequently occurred in relation to the treatment of webcasting under the 2000 amending legislation.

Internet Streamed Audio and Video Content Issue

The definition of "broadcasting service" in section 6 of the Broadcasting Services Act 1992 (BSA) contains a number of exceptions including "*a service that makes programs available on demand on a point-to-point basis, including a dial-up service*". For some time prior to the introduction of the 2000 legislation, there had been uncertainty in Australia as to whether the making available of media/content to end-users over the Internet constituted a broadcasting service or whether it fell within this exception. The possibility that it might constitute a commercial broadcasting television service (as defined in the BSA) was particularly problematic because of the offences that are committed by any person who broadcasts a commercial service without a licence and because of the moratorium on the issuing of any new licences for such services contained in the 1998 legislation. This uncertainty was acknowledged by the Minister in his Second Reading speech when he introduced the 2000 legislation into Parliament.

It was originally proposed that the ABA would consider this issue at the Minister's request and report by the beginning of 2002. The very existence of this planned review caused great unease in the Australian Internet industry. For many operators setting up Internet streaming businesses, uncertainty was better than a decision that the exemption did not apply (although of course uncertainty involved some risks).

The Internet Industry Association (IIA) undertook intensive lobbying of the Minister for assurances the streaming did not constitute broadcasting and that clarifying amendments would be made. On 28 June 2000, very late in debate on the 2000 legislation, a provision was included at the opposition's instigation requiring the Minister to conduct a review into the issue by 1 January 2002 and the preparation of a report on the outcome to be tabled in Parliament. Interestingly, the ABA gave evidence at the hearing of the Senate Environment, Communications, Information Technology and the Arts Committee on the 2000 legislation on 1 June 2000 that it had not yet commenced the review it was to undertake at the Minister's request. After more intense lobbying by the IIA, the Minister suddenly announced on 21 July 2000 (after the 2000 legislation had been passed but not yet assented to) that the government had completed a review and decided that Internet video and audio streaming should not be regarded as a broadcasting service. The Minister also announced that any necessary legislative changes would be made to clarify the situation.[33] However, where the broadcasting services bands are used to deliver such content it will be regulated under the new arrangements contained in the 2000 legislation.

Clearly the IIA prevailed. It is interesting that the government made this decision without going through the full process of discussion and option papers and submissions etc as occurred in relation to the other reviews. It is possible that the government took this approach in relation to the internet industry because of the controversy which arose last year when the government sought to impose regulation on internet content.[34]

Because it only seeks to regulate datacasting using the broadcasting services bands, the 2000 legislation has failed to deal with the interface between Internet services provided using telecommunications networks and services provided using the broadcasting services bands.[35] Presumably this will have to be revisited as technological convergence continues.

HDTV/SDTV

Australia has very much struck out on its own in relation to format standards by mandating HDTV with a "must carry" SDTV requirement as well. When HDTV was first mandated in the 1998 legislation, it was anticipated that HDTV would be the predominant technology in the United States, Western Europe and Japan. Although that has not proven to be the case, Australia has stuck with its original selection. In the United Kingdom, SDTV has been selected. The United States is the only other country to have so far imposed the HDTV format by legislation and take-up has been disappointing due to the cost of the technology required to view the format.[36]

Again, further reviews will be held in relation to HDTV/SDTV issues. Should broadcasters be finding it difficult to fulfil their quotas due to a lack of available HDTV content, because so few other countries are using the format and are therefore not producing content in that format, the current arrangements may need to be revised.

The Reviews Are Not Over Yet - Where To From Here?

Despite the extensive fleshing out of Australia's digital conversion arrangements which is contained in the 2000 legislation, much remains to be done. The government is continuing its approach of extensive reviews due to the difficulties of predicting future technological developments. The 2000 legislation again provides for multiple reviews with various deadlines over the next 5 years, including (by 1 January 2003) into whether any amendments should be made to the new datacasting regulatory arrangements.

Conclusion

No one seems to be happy with the outcome of the regulatory process except the FTA commercial broadcasters. The potential datacasters who had spent two years developing business cases which they now say are rendered marginal by the new arrangements are particularly unimpressed.[37] The government has also imposed a heavy review workload on itself and a potentially substantial new role on the ABA (without providing the ABA with any additional resources).

Although a complete overhaul of the broadcasting arrangements might have been preferable, including consideration of the meaning of a "broadcasting service" it was possibly just too early because it is not yet known what some of the new concepts such as datacasting will look like in practice. Perhaps the most optimistic approach would be to assume that the conceptual distinctions now imposed will become meaningless once the moratorium protecting the existing FTA commercial broadcasters is lifted after 31 December 2006.

It is also interesting to note that during 1999, a separate but concurrent review of Australia's regulation of broadcasting was undertaken by the Productivity Commission, at the request of the Treasurer. The Productivity Commission reported on 3 March 2000.[38] Its report recommends wide-reaching changes, including revisions to the arrangements relating to foreign ownership and control which are beyond the scope of this paper and about which the government has yet to announce its view. However, the Productivity Commission also expressed the view that the government's policy in relation to datacasting "stifles competition and innovation" and that regulatory restrictions on datacasting, multi-channelling and interactive services:

> "*…will be costly to Australian consumers and businesses alike. They will delay consumer adoption of digital technology and deprive business of opportunities to develop new products and services for the world as well as Australian markets. They could have a particularly severe effect on regional consumers who have limited access to other broadband digital platforms*".[39]

1 September 2000

Jane Forster is a partner and Caroline Lovell is a senior associate with the Sydney office of the national law firm Clayton Utz. The views expressed in this article are the authors' own and are not necessarily those of their firm or any of its clients.

End Notes

[1] *Television Broadcasting Services (Digital Conversion) Act 1998* and *Datacasting Charge (Imposition) Act 1998*. Collectively referred to as the 1998 legislation.

[2] By virtue of amendments to the *Radiocommunications Act 1992*. See also the *Explanatory Memorandum* for the 1998 legislation.

[3] *Explanatory Memorandum* for the 1998 legislation.

[4] Section 6 of the BSA includes certain exceptions which will be discussed in more detail below. A "program" is defined in relation to a broadcasting service as "matter the primary purpose of which is to entertain, to educate or to inform an audience, or advertising or sponsorship matter whether or not of a commercial kind" (also by section 6).

[5] *Report of the Senate Environment, Communications, Information Technology and the Arts Legislation Committee on the Broadcasting Services Amendment (Digital Television and Datacasting) Bill 2000*, June 2000 at p99 (Minority Report by the Australian Democrats).

[6] *Broadcasting Services Act 1992* (as amended by the *Television Broadcasting Services (Digital Conversion) Act 1998*) Schedule 4, Part 8, clause 59(1).

[7] "Digital Broadcasting and Datacasting" issued by the Minister on 21 December 1999 (Q & A format) and press release "Digital - new choices, better services for Australians" of the same day.

[8] Three volume document, *Reports on Digital Television Reviews*, December 1999.

[9] "Digital - new choices, better services for Australians", press release by the Minister on 21 December 1999.

[10] *Report on Digital Television Reviews*, December 1999, Volume 1 at p39.

[11] It appears, for example, that this will permit two Wimbledon matches being played at the same time but on different courts within the same venue to be broadcast at the same time.

[12] The government initially imposed the same obligation on the ABC and SBS (although SBS was to be allowed to include some material produced in SDTV and "upconverted" to HDTV). The quotas for the national broadcasters were later made somewhat more flexible to take into account their diverse programming sources: *Broadcasting Services Amendment (Digital Television and Datacasting) Bill 2000*, Second Reading Speech at p2.

[13] *Submission from AOL Bertelsmann On-Line Services to the Review into the Scope of Datacasting Services*, December 1998 at page 7 - "to capture the essence of broadcasting services - those key attributes that makes it more appropriate to be more heavily regulated than other information services".

[14] News Limited, *Submission to the Review into the Scope of Datacasting Services*, December 1998 at page i.

[15] Cable & Wireless Optus, *Submission to Review on Datacasting*, 22 January 1999, at p1.

[16] *Report on Digital Television Reviews*, December 1999, Volume 2 (Review into the Scope of Datacasting Services and Enhanced Services at p5ff) and Appendix 1 (at p83ff).

[17] Shadow Minister, Stephen Smith: *Hansard*, 5 June 2000 at p17018. Despite the short time available, the 2000 legislation was considered by the Senate Environment, Communications, Information Technology and the Arts Legislation Committee which took submissions from interested parties (generally along the same lines as such parties had already submitted to the DOCITA reviews) and held public hearings on 31 May and 1 June 2000. A report was produced on 8 June 2000 (see note 5 above) which recommended only some minor changes to the legislation, some of which were adopted (including that the ABC and SBS be permitted to broadcast their radio services through their digital channels to enable more rural areas to be reached).

[18] In response to the Shadow Minister, Gary Hardgrave said (*Hansard*, 5 June 2000 at p17022) that he was "disappointed those opposite are still flopping around trying to find reasons to be negative and scare people".

[19] One Democrat Senator, Vicki Bourne, who was heavily involved in the debate about the 2000 legislation, described the lobbying as having been "reasonably intense": Hansard, 21 June 2000 at p15383. At the very last minute substantial government amendments were introduced which permitted the national broadcasters to undertake extremely restricted forms of multi-channelling when it had earlier looked as if more generous arrangements might be agreed. These restrictions seems to have been heavily influenced by the interests of the FTA commercial broadcasters.

[20] Senate Committee debate, *Hansard*, 27 June 2000 at p15731ff.

[21] Senate Committee debate, *Hansard*, 27 June 2000 at p15737ff.

[22] Hansard, 27 June 2000, at p15745 and 15747, respectively.

[23] During debate about the 2000 amending legislation in the House of Representatives, Gary Hardgrave, a liberal (government) member said that "We have, without doubt, a desperate need to make sure the mature players in our television industry understand this government is giving them the tools to go ahead and do what they say they can do": *Hansard*, 5 June 2000, at p17019. The traditional justification for this policy is the protection and continuation of a high standard of FTA broadcasting, including high levels of Australian content.

[24] The SDTV requirement was apparently introduced because a number of potential datacasters argued that their business cases depended on reasonably low priced digital receivers: *Reports on Digital Television Reviews*, December 1999, Volume 1, at p60.

[25]*Report on Digital Television Reviews*, December 1999, Volume 2 at p65ff.

[26] Incorporating some minor changes to the regulatory approach to datacasting made during parliamentary debate about the 2000 legislation (see below).

[27] *Broadcasting Services Amendment (Digital Television and Datacasting) Act 2000*, Schedule 6.

[28] Under the *Radio communications Act 1992* as amended by the *Broadcasting Services Amendment (Digital Television and Datacasting) Act 2000*. The ACA has issued a Discussion Paper to "promote discussion and invite comments" on issues relating to the issues of these licences such as the allocation method, lot arrangements ("national coverage" or by geographical regions), competition issues etc. It is anticipated that an auction to allocate licences will be held in November/December 2000. Spectrum will be allocated in channels of 7MHz and will be located in bands 4 or 5 of the television broadcasting bands. Content licences will not be issued for a particular period but, like individual commercial broadcasting licences, will continue provided the licence conditions are met and the datacasting charges paid.

[29] ACA, *Discussion Paper on Datacasting Transmitter Licence Allocation* at p6-7.

[30] *Hansard*, transcript of hearing of Senate Environment, Communication, Information Technology and the Arts Committee on 31 May 2000, Senator Mark Bishop at p67.

[31] *Report of the Senate Environment, Communications, Information Technology and the Arts Legislation Committee on the Broadcasting Services Amendment (Digital Television and Datacasting) Bill 2000*, June 2000 at p100 (Minority Report by the Australian Democrats).

[32] *Reports on Digital Television Reviews*, December 1999, Volume 3, section 8.

[33] Senator Alston, press release "Video and Audio Streaming" 21 July 2000. The Minister made a Determination under section 6(1)(c) of the *Broadcasting Services Act 1992* confirming this on 12 September 2000.

[34] The *Broadcasting Services Act 1992* was amended in late 1999 to include a regulatory regime for internet content (in Schedule 5) which commenced on 1 January 2000.

[35] Although clause 23B of the new Schedule 6 of the *Broadcasting Services Act 1992* is intended to deal with schemes set up to provide datacasting services that consist of internet carriage services in order to avoid the application of the datacasting licensing arrangements.

[36] *Report of the Senate Environment, Communications, Information Technology and the Arts Legislation Committee on the Broadcasting Services Amendment (Digital Television and Datacasting) Bill 2000*, June 2000 at p69 (Minority Report by Labour). Japan had also done so but implementation dates have been deferred, suggesting a reconsideration of the format.

[37] As soon as the 2000 legislation was passed a number of the potential datacasters withdrew from digital transmission trials.

[38] Productivity Commission, *Broadcasting Inquiry Report*, Report No. 11, 3 March 2000.

[39] Ibid, at p14-15.

Back to top of page **Back to the sessions page**

Néstor O. Criscio

CURRICULUM

Néstor O. Criscio is a broadcast engineer certified by the Society of Broadcast Engineering (U.S.A.). He has a great experience in wireless telecommunication technologies, calculation and designing of radio communications systems, antenna designing and construction of control devices for industry, etceteras.

Although at the beginning of his career, his activity was pointed on the electrical engineering, for more than twenty years he has forged a multi-disciplinary profile that can be defined as Manager-Administrator-Engineer. Beside this, he is adviser of Uruguayan Government in international telecommunications politics for mobile and satellite communications, as well as the Broadcaster Associations he is member and Director.

He is General Manager and total or partial owner of the following commercial and broadcast enterprises:

- FLEG S.A. (Import, sales, installation and service of "Two Way Radios), since 1980.
- LACOSTA FM, since1985.
- ING. NESTOR CRISCIO Y ASOCIADOS (Consultants in electrical and radio electrical engineering), since 1990.
- He is Director of Engineering of the following broadcast enterprises:
- CONCIERTO FM, since 1991.
- CX 50 RADIO INDEPENDENCIA, since 1991.
- RADIO UNO PUNTA CIENTO CINCO, since 1995.
- CONCIERTO FM 94.3 PUNTA DEL ESTE, since 1998.

He is consultant in communications and strategies for Diveo Broadband Networks Inc., which headquarters are in Washington, USA and investments in Uruguay and other countries.

He is adviser in telecommunications for Tenfield S.A.

Since 1993, he is the President of the Technical Committee and Board Director of the National Association of Uruguayan Broadcasters (A.N.DE.B.U. an association, which represents about two hundred broadcast stations).

Since 1994, he is the President of the Technical Committee and Board Director of the International Association of Broadcasters (A.I.R. an association, which represents more than seventeen thousand broadcast stations).

Since 1994, he is a member of the Technical Committee of the World Broadcasting Unions (the following organisations are members of this Union: Asia Pacific Broadcasting Union [ABU]; Arab States Broadcasting Union [ASBU]; Caribbean Broadcasting Union [CBU]; European Broadcasting Union [EBU]; International Association of Broadcasters [IAB]; North American National Broadcasters Association [NANBA]; Organización de Televisión Ibero-Americana [OTI]; Union des Radiodiffusions et Televisions Nationales d'Afrique [URTNA]).

He is usual speaker in National and International Forums, related to electrical and radio-electrical techniques, as well as broadcasting politics. He also writes about these same matters for several magazines.

He is the representative of A.N.DE.B.U. for the following organisations:

- International Telecommunications Union (UN Agency).
- Comisión Interamericana de Telecomunicaciones (O.E.A. Organisation).
- Grupo Mercado Común Sub Grupo de Trabajo 1 (Broadcasting, MERCOSUR).

He has been adviser of the following enterprises:

- SAETA TV CANAL 10
- DIFUSORAS DEL URUGUAY
- CX 30 RADIO NACIONAL
- CX 16 RADIO CARVE
- RADIOAVISO

Index

Click here to start

Table of Contents

PPT Slide

Index

The beginning

First TV Services in Mexico

Growth

Telesistema Mexicano

Analog Broadcast

TELEvisión VIa SAtélite

To Europe & Latinamerica

Digital Era

Digital TV Era

Digitalization Process

DTH in Mexico

World Standards

Digital Broadcasting

Author: Roberto Pineda B.

Download presentation source

Digital TV

Digital HDTV

Format Comparison

DTV Standard

DTV in the world

TV Digital steps

Channel Distribution

The Spectrum

The game rules...

Production (4:2:2)

Transmission (4:2:0)

Transmission (4:2:0)

Digital Tx Tests

Transmission

Reception

Tx TEST Jan. 25th 1998

At Homes

Sporadic Digital Broadcasting

Continuos Digital HDTV Broadcast

Reception Sites

HDTV Production Equipment

Sports/Special Events HDTV OB Van

Post Production HDTV Rooms

HDTV Soap opera OB Van

HDTV Studio

2001 Expectations

Future Services

Digital Broadcasting

PPT Slide

Going Digital Television in Mexico

Roberto Pineda B.
January / 16th / 2001

BEST COPY AVAILABLE

Index

- Introduction
- Brief History of Mexico´s TV
- Digital Era
- HDTV & DTV
- First DTV Transmissions
- Today´s status
- This Year expectations
- The Future

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The beginning

In the World

- 20’s Radio
- 30’s b/w TV
- 40’s Color TV Color TV patent)

Mexico

- 30’s Radio (XEW), (XHTV-4)
- 60’s Color TV

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First TV Services in Mexico

On September 1st, 1950
XHTV-4 starts

In 1951 the first repeater
station is installed.

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Growth

In 1951

XEW-TV C-2 starts

In 1952 beginning of XHGC C-5

New repeater stations merge since 1953 all over the country

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Telesistema Mexicano

- In 1955 channels 2, 4 & 5 conforms Telesistema Mexicano
- Air Signal, or Video Tapes Distribution

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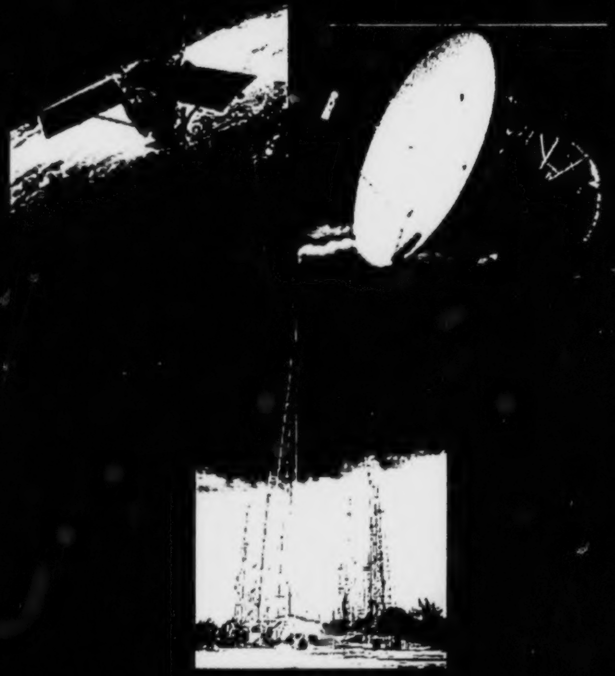
Analog Broadcast

Characteristics

Conventional Technology (6 MHz) and terrestrial, satellite, cable, distribution, etc.

Highly affected by interference or attenuation and require the whole channel bandwidth for just one signal



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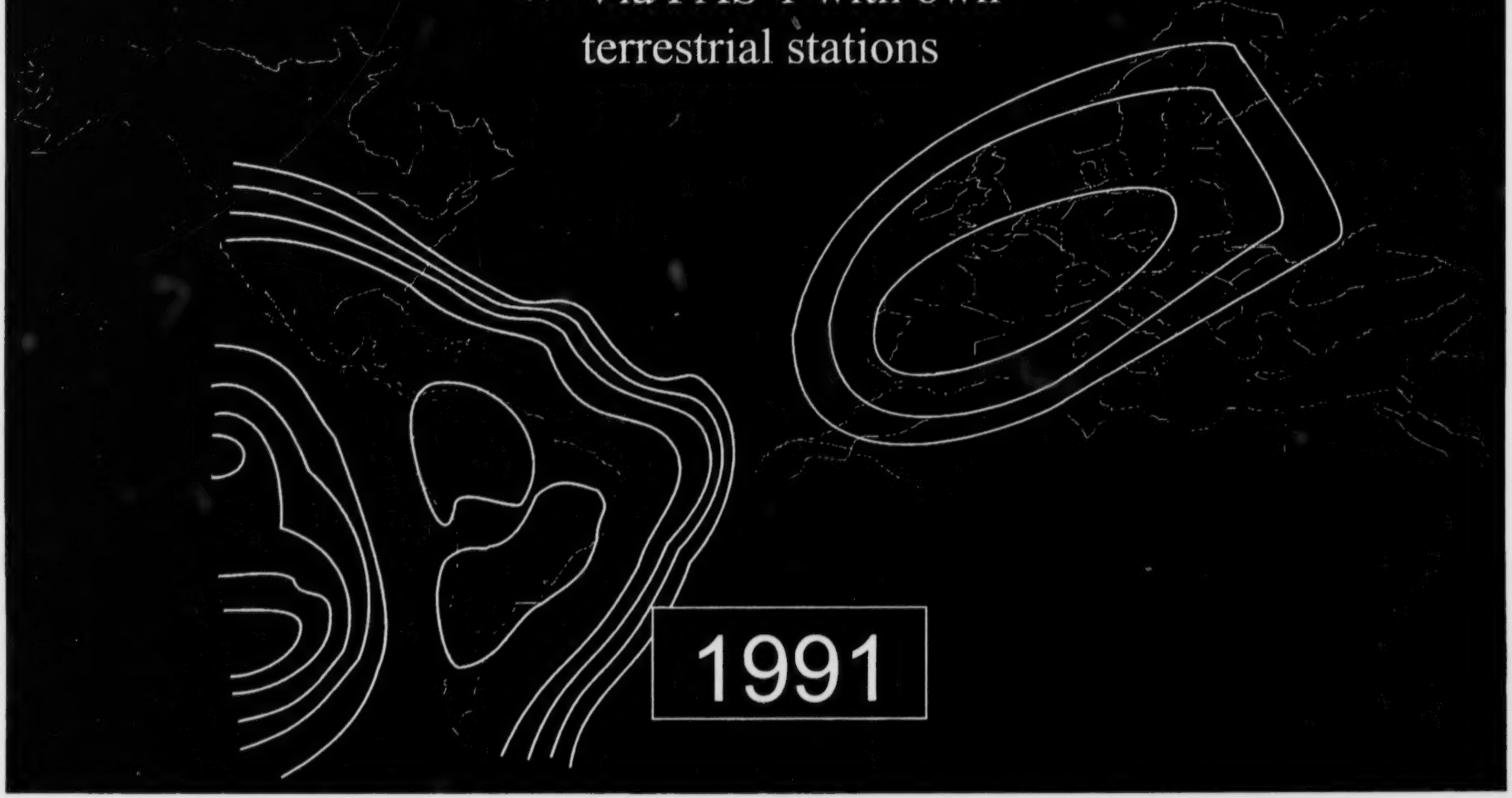
TELEvisión VIa SAtélite

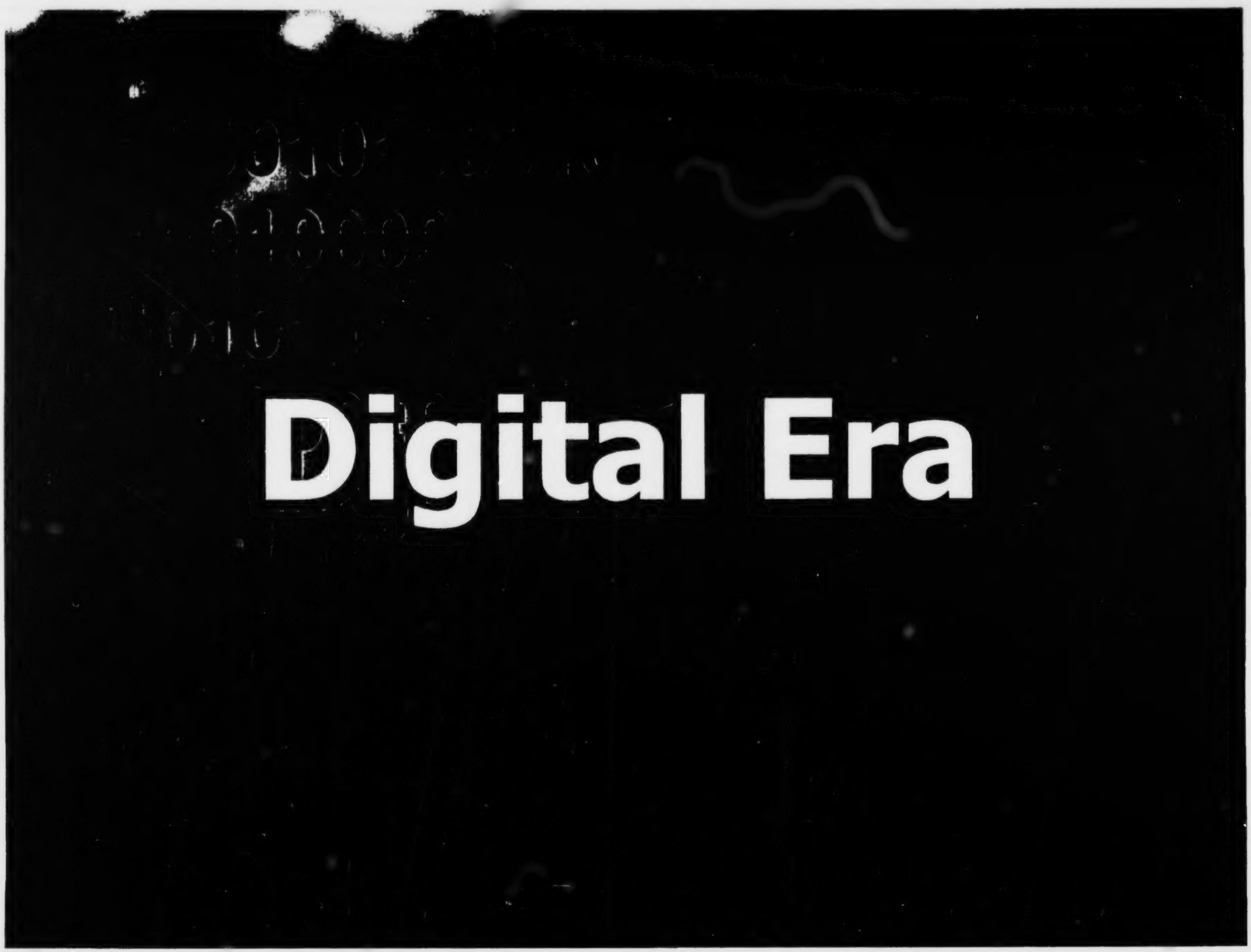
- In 1967 color television arrives to Mexico
- In 1968 Cable TV starts with Cablevisión
- In 1973 TELEVISA is conformed

To Europe & Latinamerica

- ↗ Via PAS-1 with own terrestrial stations



1991



Digital Era

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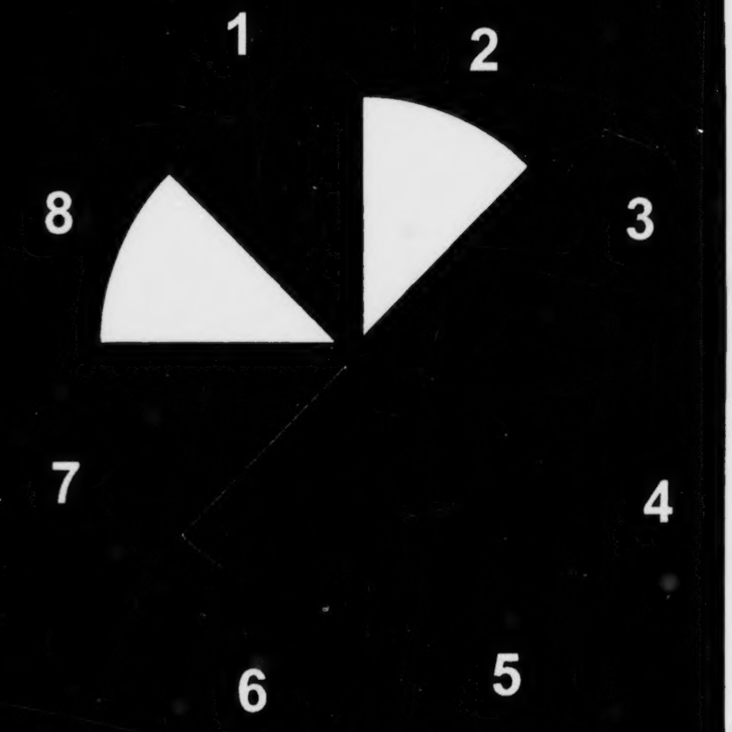
Digital TV Era

To make more efficient the use of Voice, Video & Data Channels.

Less intermod., more robust signal, "programmable" quality from 1.5 to 45 Mbps



n services sharing available bandwidth

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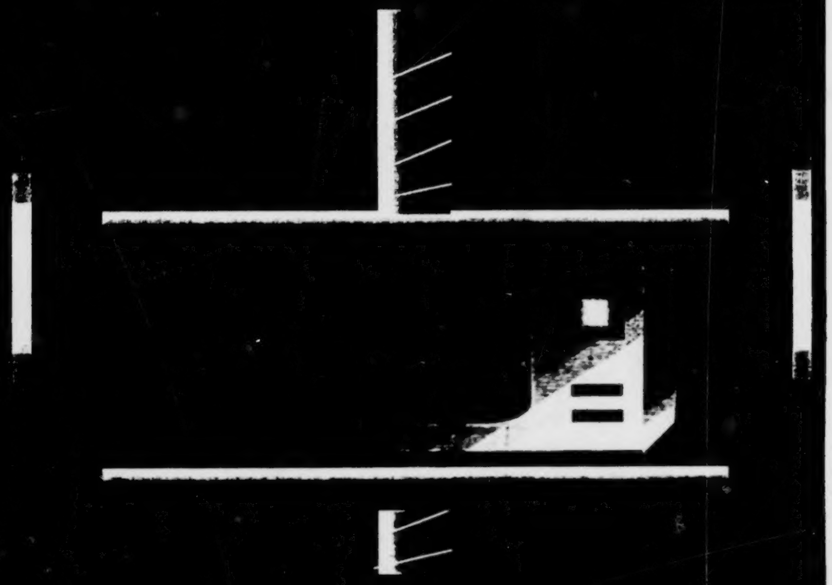
Digitalization Process

Complete Digital Facilities since 1992.

Digital Adquisition, Internal Distribution, Recording.



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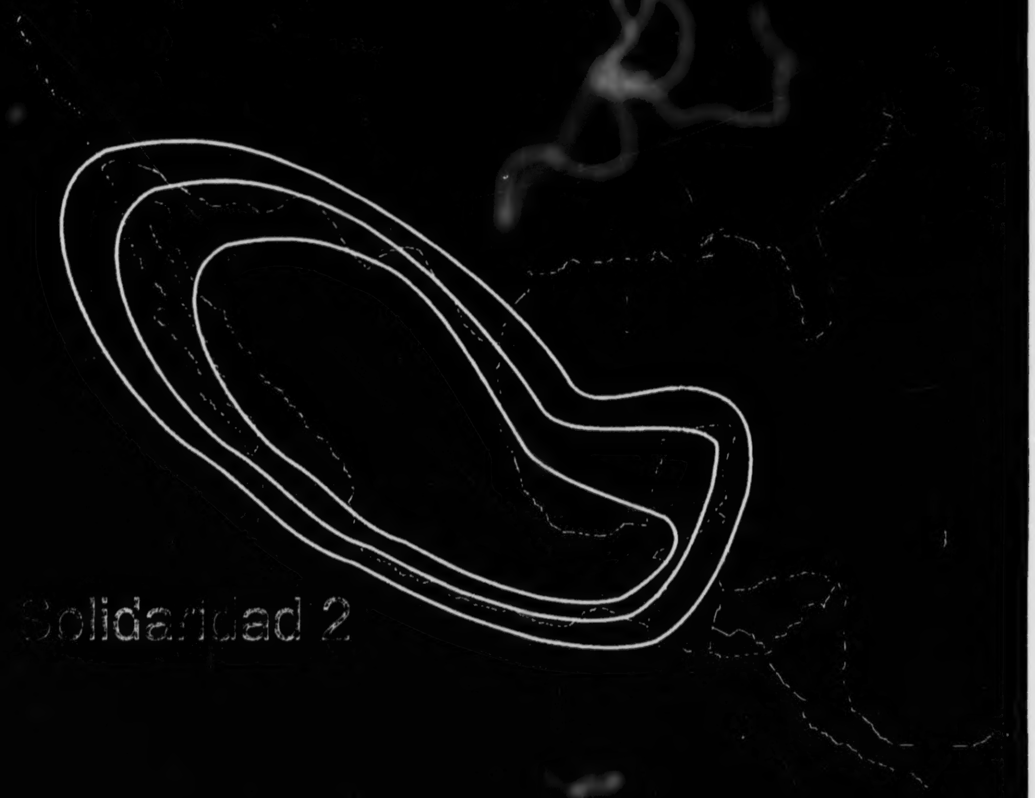
DTH in Mexico


Solidaridad 2

- In 1996 SKY & DirecTV services are implemented

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World Standards

World Standards

DVB (Europe), ATSC (America), ISDB (Japan)

DIGITAL VIDEO BROADCASTING

ADVANCED TELEVISION SYSTEMS COMMITTEE

Characteristics

High Technology and programmable quality SDTV / HDTV (1.5 - 20 Mbps)

One or several signals per channel

DVB (Tx), ATSC (Tx), SDI (Distribution)

Distribution: terrestrial, satellite, cable, Internet, Telephone, Optical Fibre, etc.

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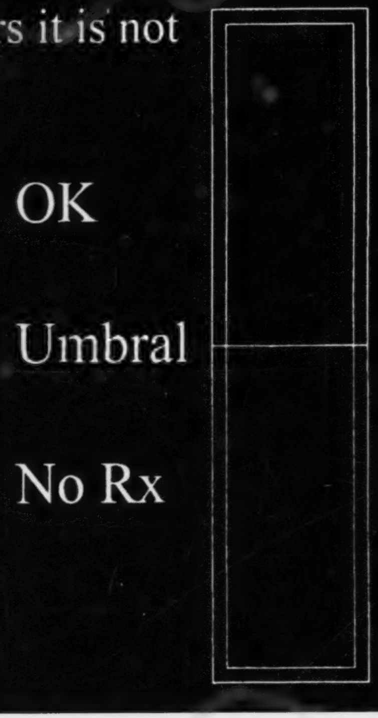
Digital Broadcasting

Advantages and Disadvantages

More robust signals (Rx quality = Tx)

Less bandwidth required (less power)

If high interference or attenuation occurs it is not possible to receive the service



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Digital TV

Formats

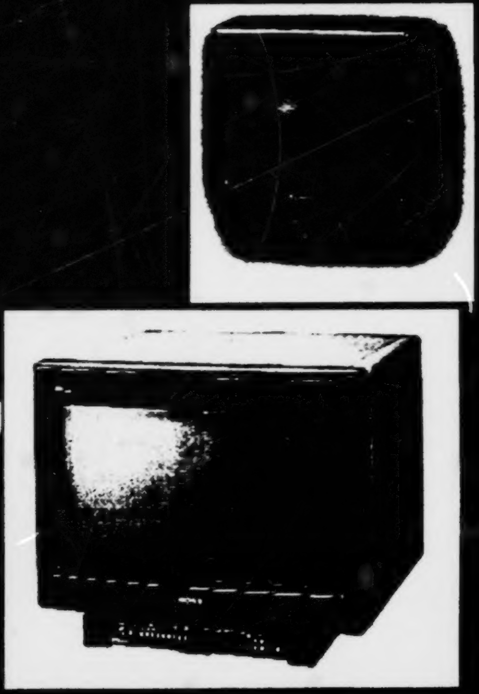
SDTV or HDTV in 3:4 & 16:9 formats

Better impact and purity

SDTV (2 a 6 Mbps)

HDTV (19.4 Mbps) is the most attractive service

Dig



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Digital HDTV

Digital TV Service with similar resolution
of 35 mm film plus 6 audio channels
More detail Images
Aspect Ratio: 16:9
Better reception with less power.
Surround Sound

Format Comparison

MPEG-2

4:3
(525 lines SDTV)

SDTV

(INTERLACED OR PROGRESSIVE)

MPEG-2

16:9
(1080 lines HDTV)
(525 lines SDTV)

HDTV 2'073,600 pixels
SDTV 337,920 pixels

(INTERLACED OR PROGRESSIVE)

DTV Standard

Only for MPEG-2 Tx (HDTV y SDTV)
19 Mbps for VHF/UHF & 38 Mbps for Catv, Satélite o Microondas

ATV System Scanning Formats

Vertical Lines	Horizontal Pixels	Aspect Ratio		Picture Rate			
1080	1920	16:9		60i	30i	30P	24P
720	1280	16:9			30i	30P	24P
480	704	16:9	4:3	60i	30i	30P	24P
480	640		4:3	60i	30i	30P	24P

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DTV in the world

ATSC DTV standard has been adopted in United States, Korea and Canada

In Europe, DVB standard has been adopted

Brasil, Chile and Argentina seriously evaluate ATSC standard

DTV transmissions have started in Mexico

The main restriction is for sure the conditional access

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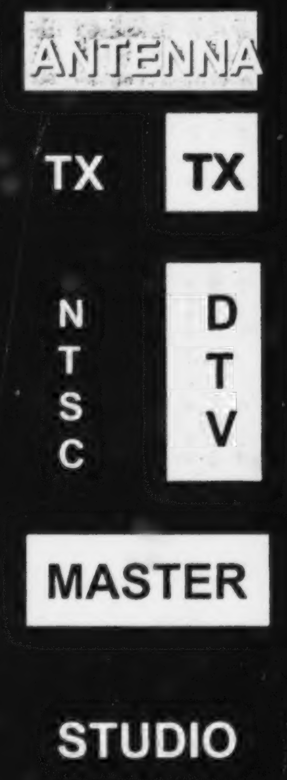
TV Digital steps

- Secondary Channels Assignment (DTV).
- Two channel operation (Analog and Digital).
- New Spectra distribution.
- Analog channels turn off schedule.


ANTENNA
TX
TX
NTSC
DTV
MASTER
STUDIO

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Channel Distribution

TODAY

VHF **UHF**

2-4	5-6	7-13	14-51	52-69

- * Channels 2 - 51 to be used at the of transition
- * From 1 to 6 services (HDTV, SDTV) per channel
- * NTSC turn off not defined yet
- * Verify possible impulsive noise in low channels and possible cable problems.

* Other application channels

FUTURE

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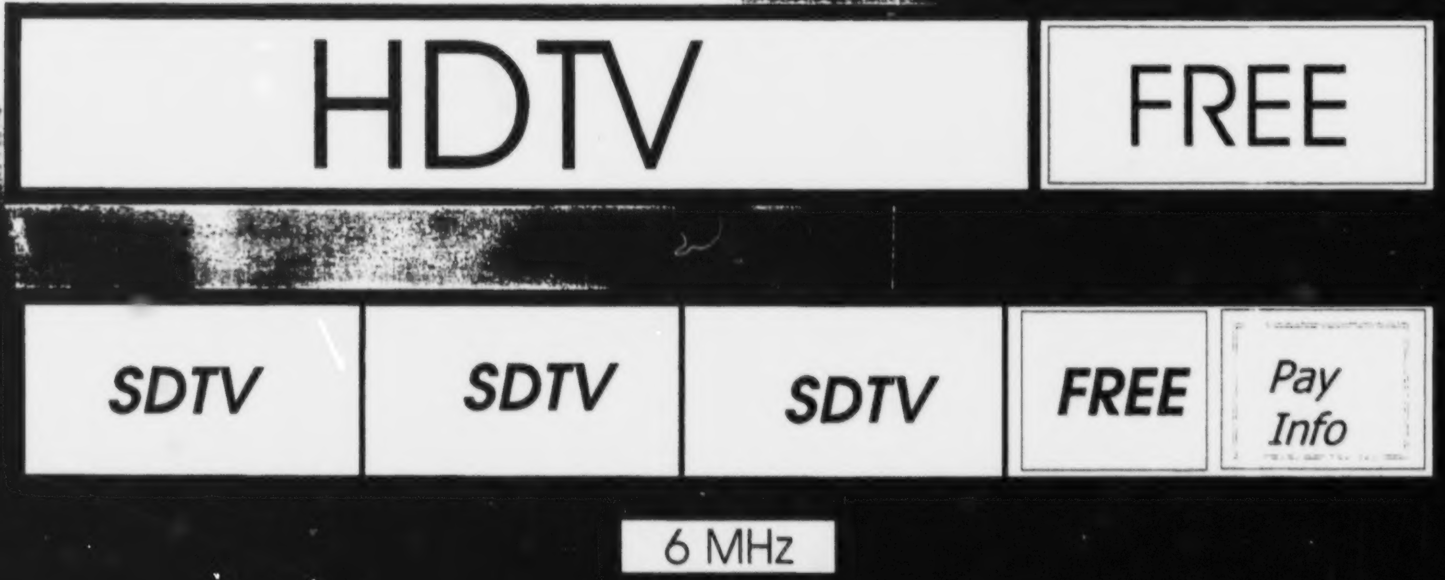
The Spectrum

Bandwidth capacity usage


HDTV
FREE
SDTV
SDTV
SDTV
FREE
Pay Info
6 MHz

The game rules...

Cable Must Carry

Compatibility

Standard Receiver

At least one free channel with same quality and transmission hours as today service

Obligatory HDTV

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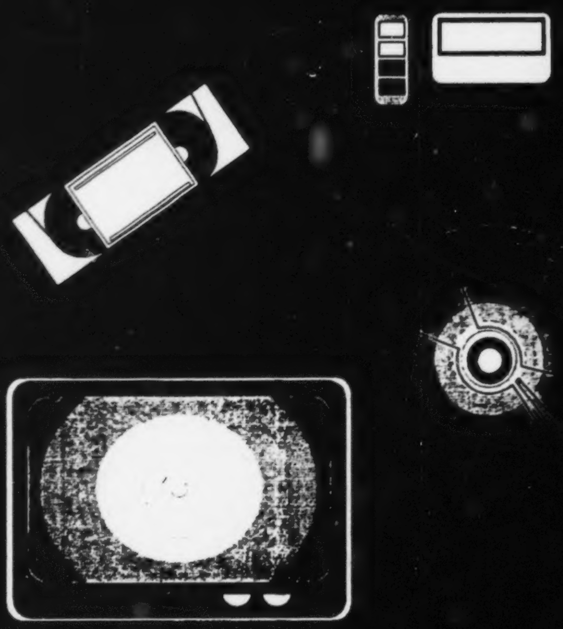
Production (4:2:2)

Digital Equipment :

- Recording
- Conduction in station: Converters, Digital Systems and Networks
- Edition
- Storage: Hard Disks and Tapes



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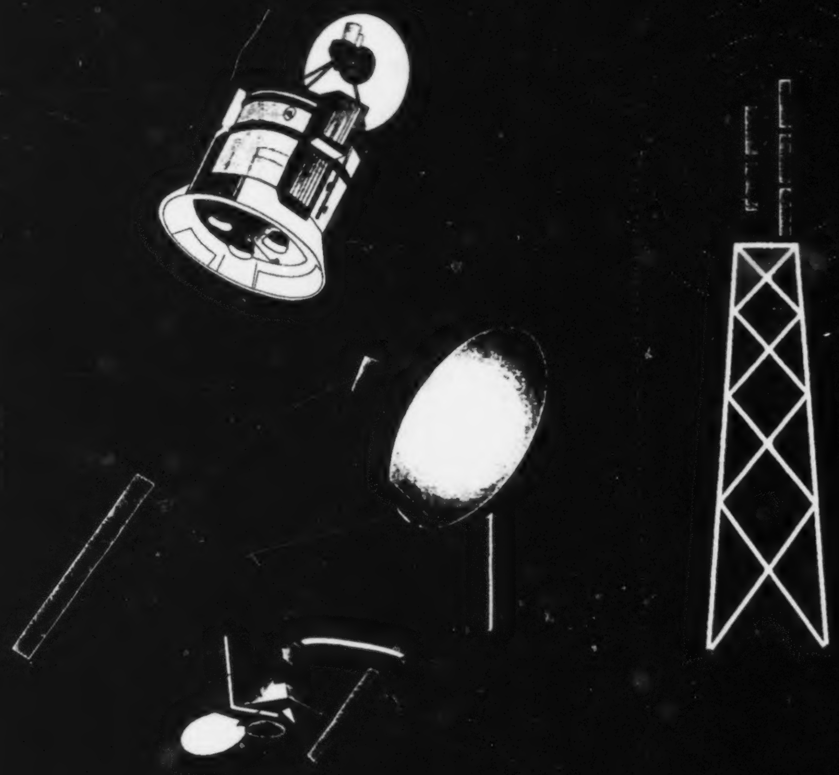
Transmission (4:2:0)

Terrestrial-Aerial VHF/UHF

Satellite DTH, DBS

Terrestrial-Fisically Cable,

Telephone, Optical Fibre



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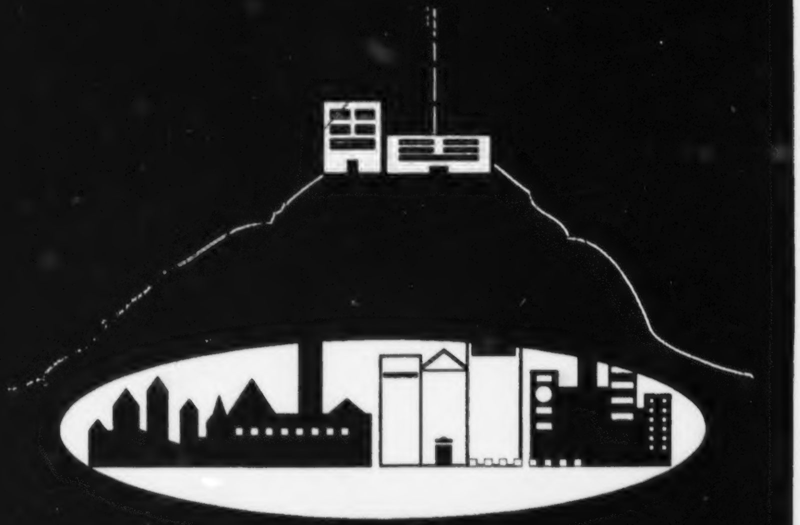
Transmission (4:2:0)

Less than 30% of power

Receiver: “intelligent” IRD MPEG-2 DTV with special monitor and/or compatible output for conventional TV sets

NTSC: 20 Kw DTV: 7 Kw



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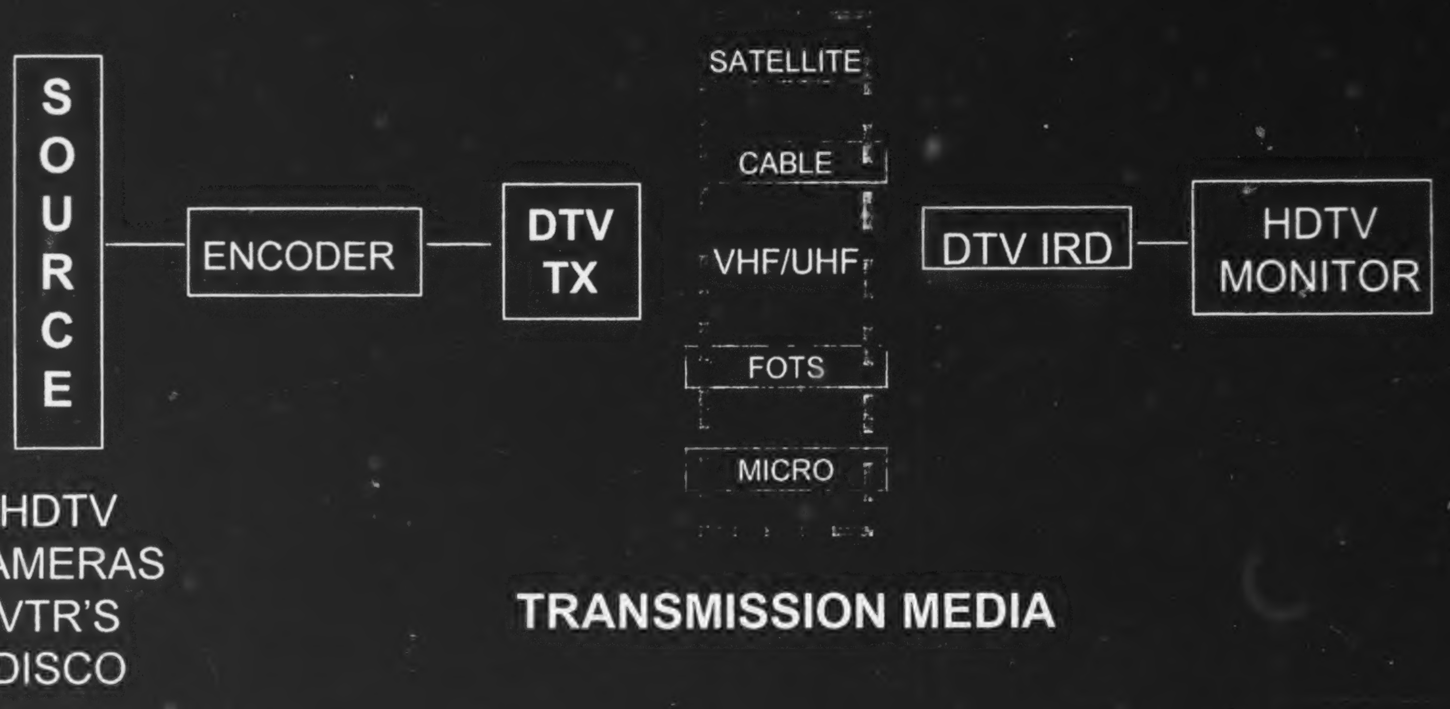
Digital Tx Tests

Basic Block Diagram


SOURCE
ENCODER
DTV TX
SATELLITE
CABLE
VHF/UHF
FOTS
MICRO
DTV IRD
HDTV MONITOR

HDTV
CAMERAS
VTR'S
DISCO

TRANSMISSION MEDIA

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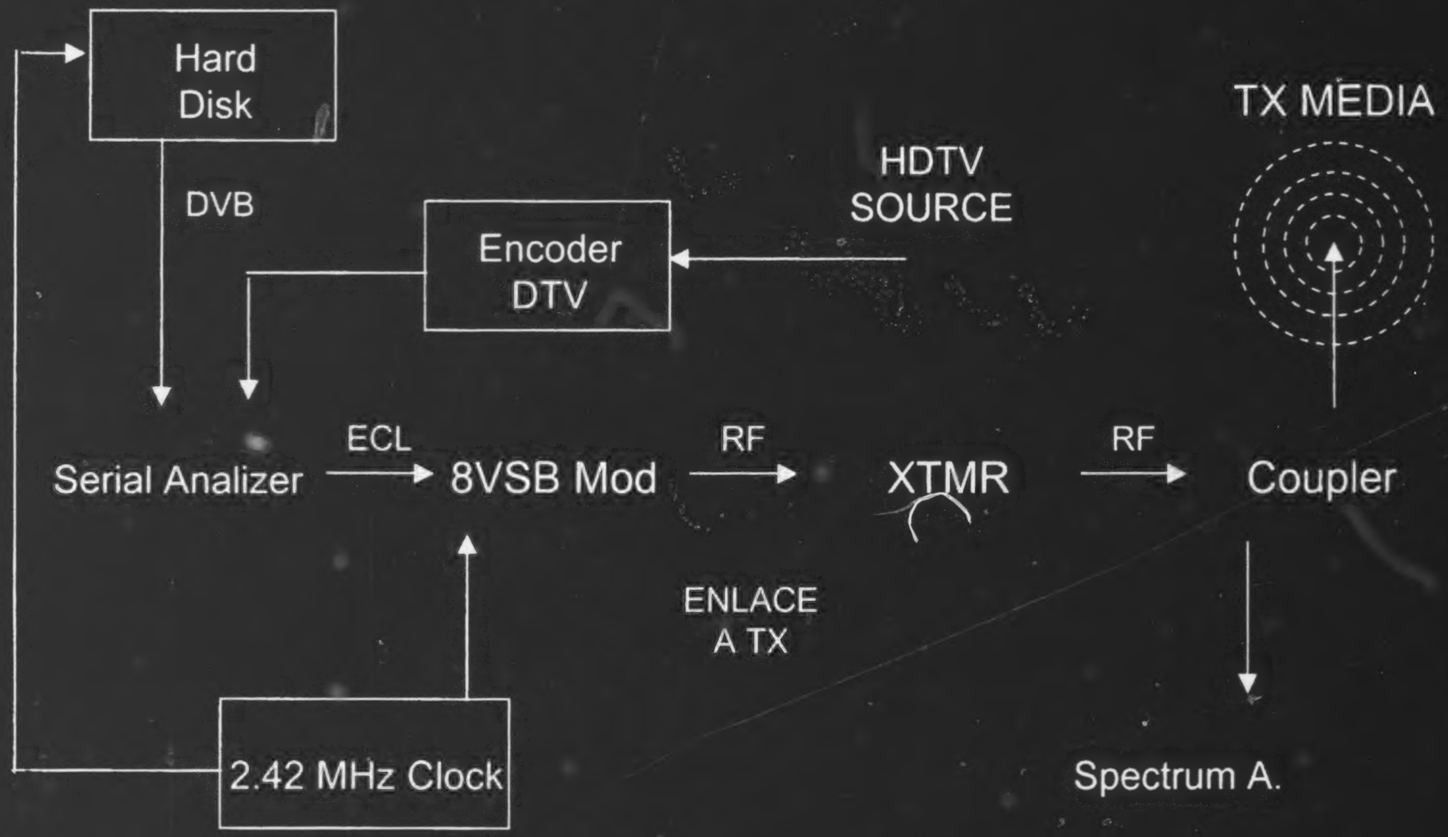
Transmission


Hard Disk
DVB
Encoder DTV
HDTV SOURCE
TX MEDIA
Serial Analizer
ECL
8VSB Mod
RF
XTMR
RF
Coupler
ENLACE A TX
2.42 MHz Clock
Spectrum A.

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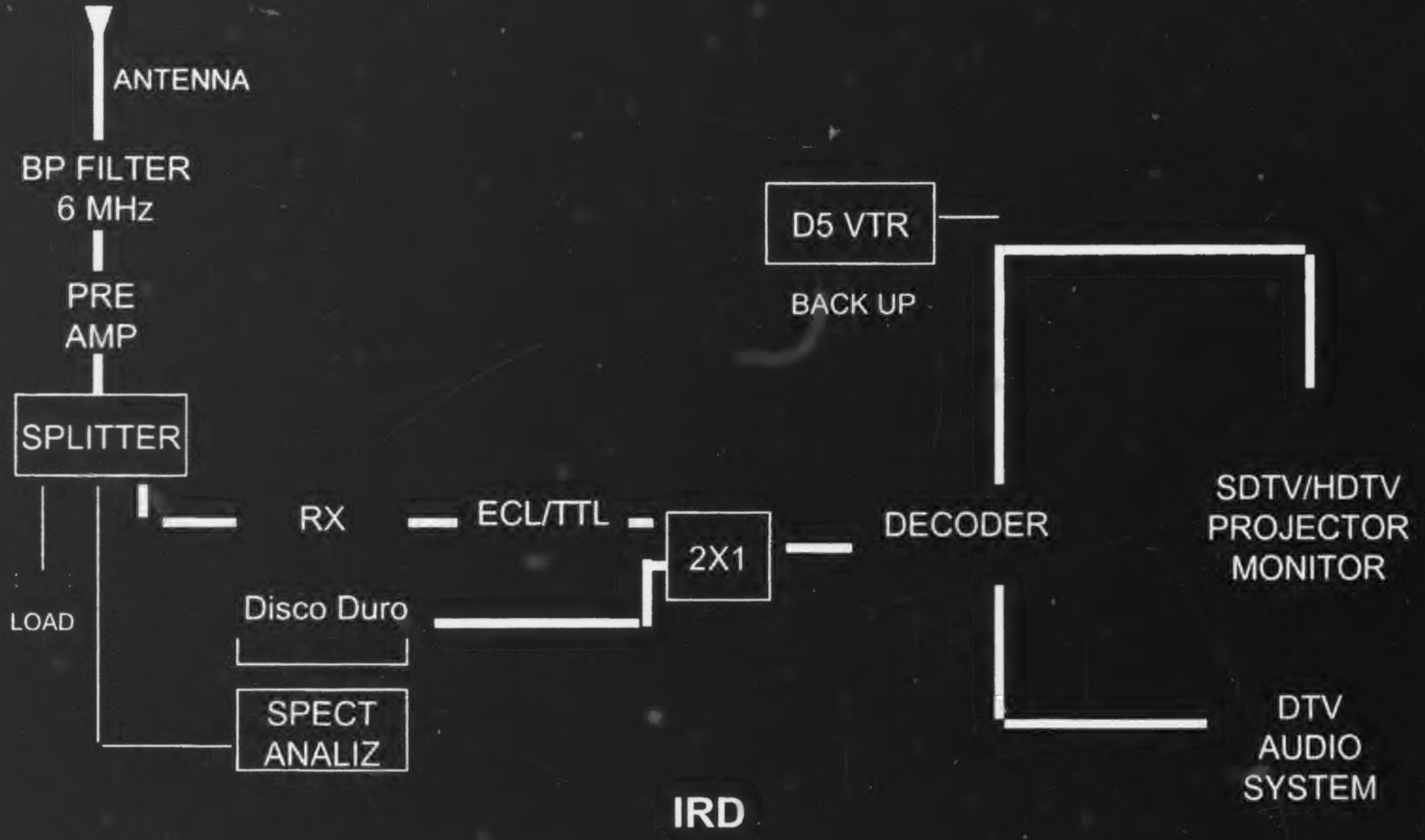
Reception


ANTENNA
BP FILTER
6 MHz
PRE
AMP
SPLITTER
LOAD
RX
ECL/TTL
Disco Duro
SPECT
ANALIZ
2X1
D5 VTR
BACK UP
DECODER
SDTV/HDTV
PROJECTOR
MONITOR
DTV
AUDIO
SYSTEM
IRD

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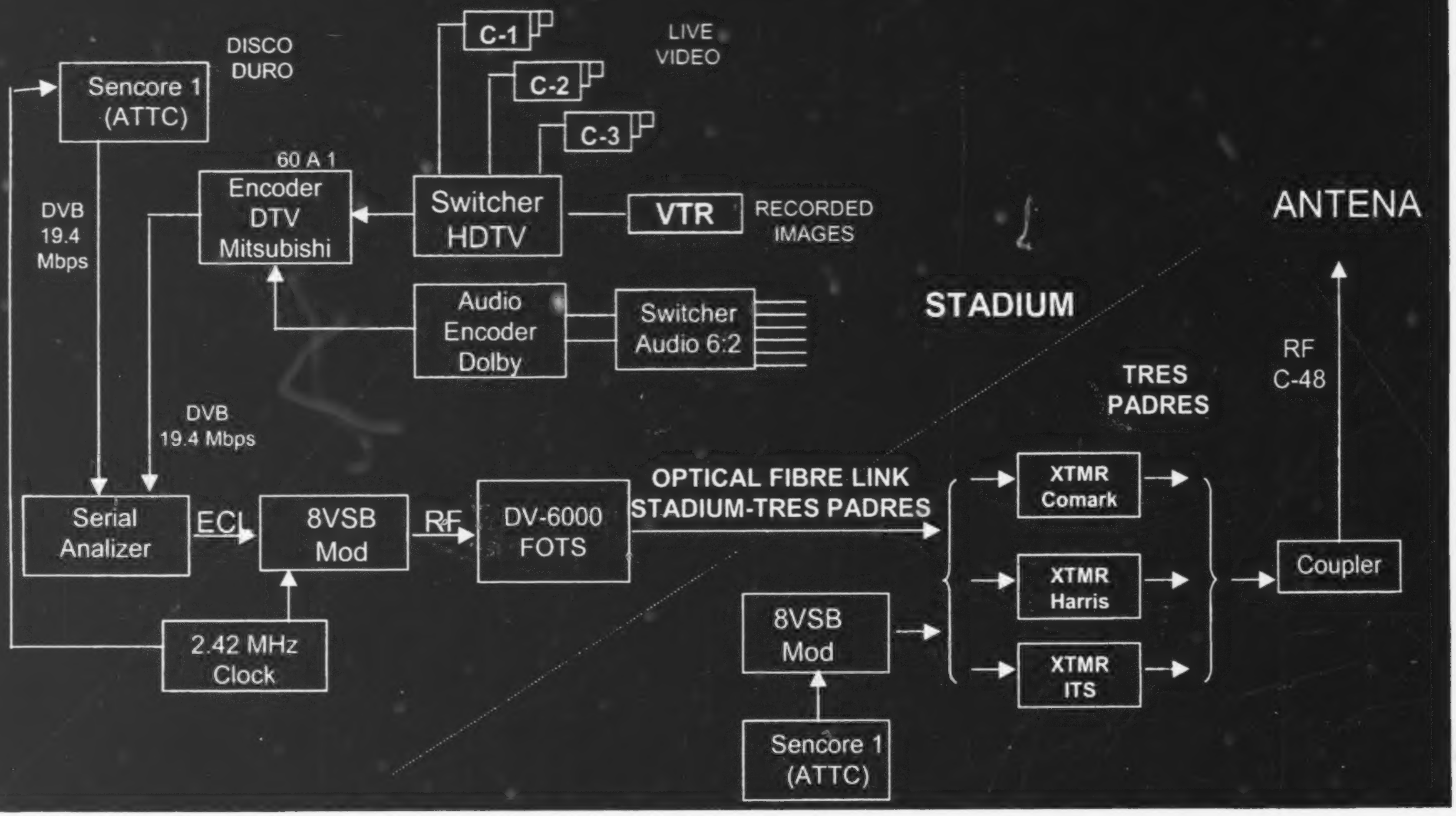
Tx TEST Jan. 25th 1998


DISCO
DURO
Sencore 1
(ATTC)
C-1
C-2
C-3
LIVE
VIDEO
60 A 1
Encoder
DTV
Mitsubishi
Switcher
HDTV
VTR
RECORDED
IMAGES
ANTENA
DVB
19.4
Mbps
Audio
Encoder
Dolby
Switcher
Audio 6:2
STADIUM
TRES
PADRES
RF
C-48
DVB
19.4 Mbps
OPTICAL FIBRE LINK
STADIUM-TRES PADRES
XTMR
Comark
Serial
Analizer
ECL
8VSB
Mod
RF
DV-6000
FOTS
XTMR
Harris
Coupler
8VSB
Mod
XTMR
ITS
2.42 MHz
Clock
Sencore 1
(ATTC)

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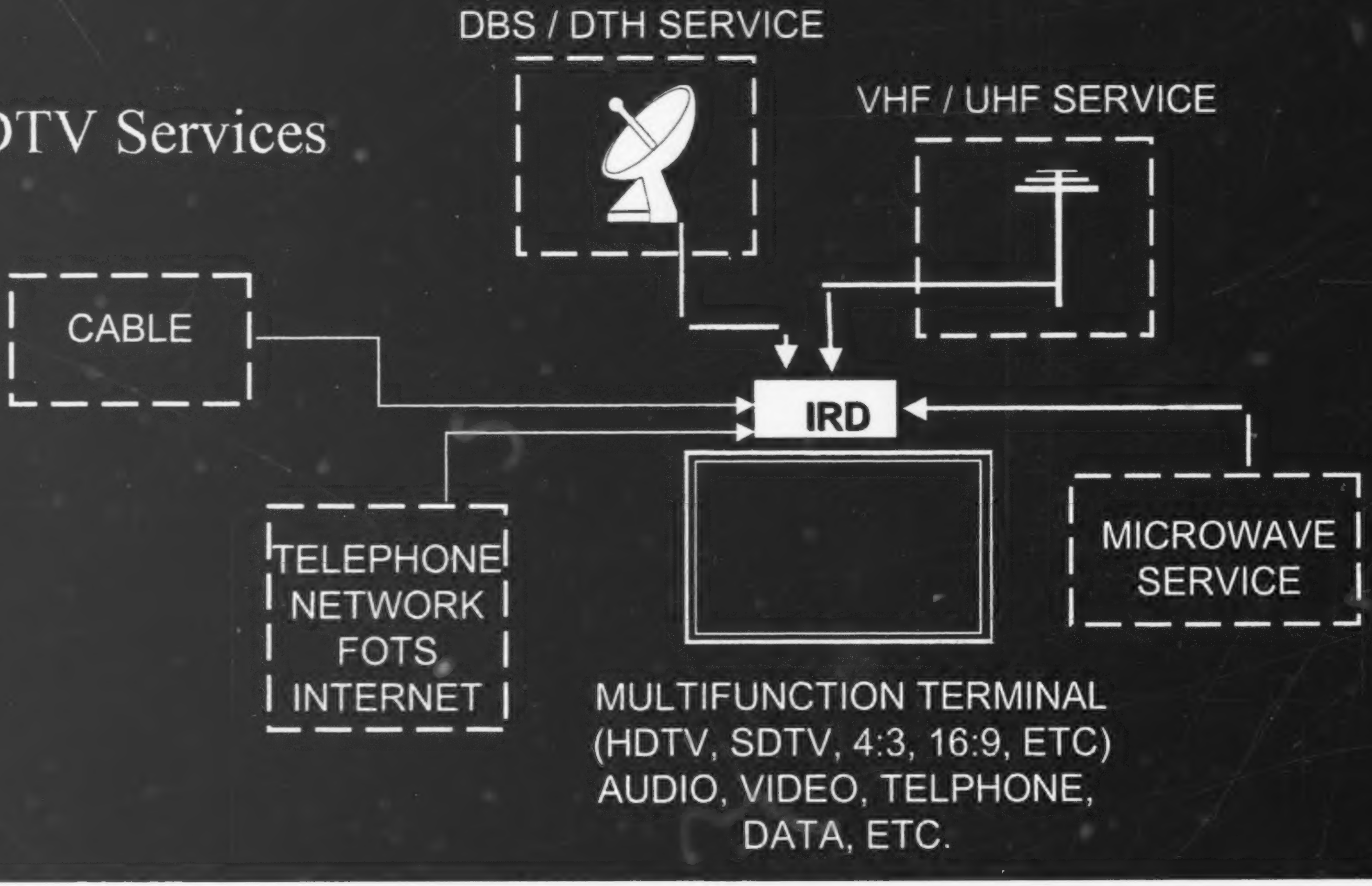
At Homes

DTV Services



DBS / DTH SERVICE
VHF / UHF SERVICE
CABLE
IRD
TELEPHONE NETWORK FOTS INTERNET
MICROWAVE SERVICE
MULTIFUNCTION TERMINAL
(HDTV, SDTV, 4:3, 16:9, ETC)
AUDIO, VIDEO, TELPHONE,
DATA, ETC.

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Sporadic Digital Broadcasting

Since February 1998 some experimental transmission were done:

2 or 3 Hours daily average

Pre-Recorded demo material

Mexico City Metropolitan area by Terrestrial Transmission

Few demonstration sites.

Channel 48 UHF

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Continuos Digital HDTV Broadcast

Since March 3th 1999

11 Hours daily Monday to Sunday

Most of the time HDTV events

Soccer games, Concerts, Nature, International Views, Parades, Musical Events, Soap Opera trailers

Pre Record at least one hour before

Sometimes 4 SDTV Channels Programming

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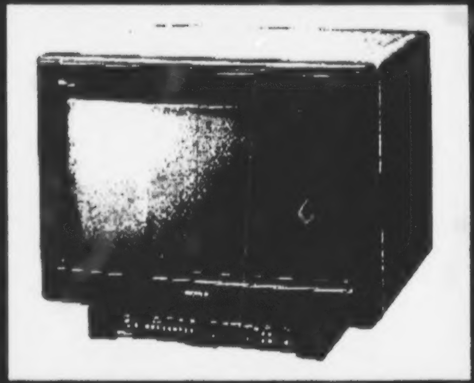
Reception Sites

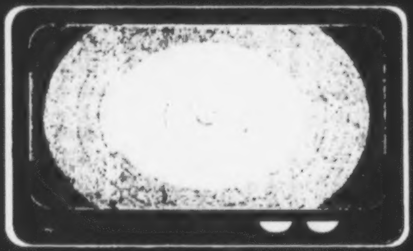


At Malls with Manufacturers Sponsorship

Already on sale some HDTV Sets

Demonstrations at Universities and Conferences

Digital Equipment Presentations



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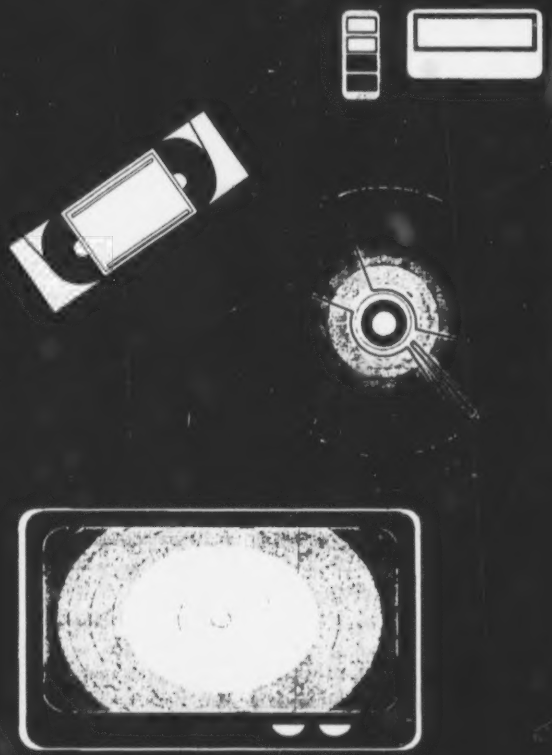
HDTV Production Equipment

- 1 Sports / Special Events OB Van
- 1 Post Production Room
- 1 Non Linear Post Production Room
- 1 Soap opera OB Van
- 1 HDTV Studio



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Sports/Special Events
HDTV OB Van

- 8 HDTV Cameras
- 2 Super Slow Motion Cameras
- Switcher & DME
- 4 VTR´s
- 2 Super Slow Motion Hard Disks
- 2 42" Plasma Displays
- 24 HD Monitors
- 50 NTSC Monitors
- 1 Oxford Audio Console 48 Ch.

1993 Ron Vesely

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Post Production HDTV Rooms

4 HD VTR´s each

Switcher, Digital Multi Effects

4 32" HD Monitors

8 20" HD Monitors

4 42" Plasma Displays

Up Converters / Down Converters

1 DMX R-100 Audio Console each

1 Non Linear "Inferno" Post Production System

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HDTV Soap opera OB Van

3 Portable HD Cameras
1 HD Camcorder
HD Switcher
6 20" HD Monitors
18 NTSC Monitors
1 42" Plasma Display
3 HD VTR´s
1 DMX R-100 Audio Console

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HDTV Studio

3 Studio Cameras

1 Portable Camera

Switcher, Digital Multi Effects System

Up Converters / Down Converters

1 Oxford Audio Console

4 HD VTR´s

9 HD Monitors

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2001 Expectations

Live Programs included in normal transmissions

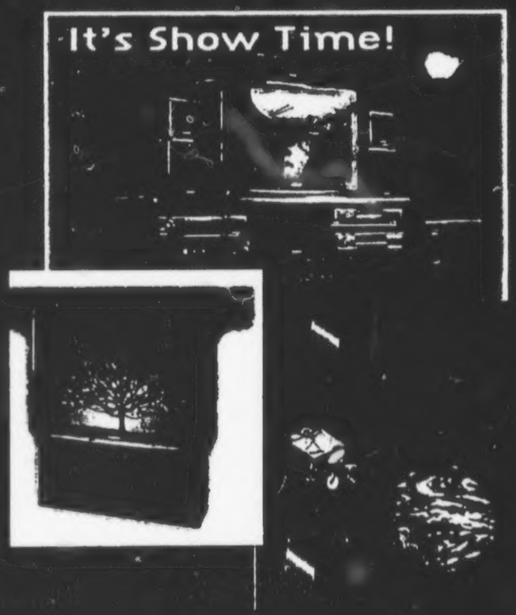
Prime Time Shows

Via Satélite Access for International Sports Events

Lower prices in receivers and HDTV sets

Start Experimental Tx at Guadalajara City

1 Additional DTV Channel by University of Mexico



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Future Services

- "Intelligent" Receivers
- DVD, Tapes, Hard Disks, etc.
- Via Satélite Distribution, FOTS, Telephone, Internet, etc.
- Multiple Services (data, TV, information, bank, etc).
- Multifunctional Interactive Terminals.

It's Show Time!

Ca

radio, news

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Digital Broadcasting

The next technological step

- *More TV services in the same bandwidth*
- *Better image and reception quality*
- *Additional services PPV, data, news, etc.*

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Going Digital Television in Mexico

Thank you

Roberto Pineda Bonilla
January / 16th / 2001

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Business & Applications

Tuesday, 16 January 2001
1100–1230

T.2.2 Communications in the Pacific Rim, Five Years into the Future

(Webcast – sponsored by Compaq)

Location: Tapa II

Chair: JIM HEBERLE, VP, Sales & Marketing, Monterey Telecommunications Technology, Inc., *USA*

This Webcast Super Session provides a forum for three distinguished leaders in Communications to provide a personal, industrial, and regional perspective on what wireless services in the Pacific Rim will be like in five years time. Societal and individual perspectives will be discussed. The challenges of 'getting there' will be defined, as will various scenarios for addressing those challenges. Ample time will be provided for audience 'grilling' of the panel. Bring your own thoughts, visions, and questions and learn about the future!

Roles of Mobile Services in Global Internet

SEON JONG CHUNG, President, ETRI, *Republic of Korea*

TAO YUN, General Manager, China, Q-east, *People's Republic of China*

MITESH DESAI, Vice President, Marketing and Business Development, Compaq Telecom, *USA*

Roles of Mobile Services in Global Internet

Seon J. Chung

PowerPoint Presentation

1. The Future of the Mobile Internet

Expected features of the future global internet services include multimedia services which are supposed to be available at near real-time speed, at any place and any time for any body at affordable cost.

Even though Global Internet will be the combination of various types of networks and information handling components, such as wireline networks and wireless networks with copper cables, optical fibres, routers, servers, computers, satellites and terminals, it seems that the wireless internet service will form the major part of it, as long as the GEO and LEO satellites fail to demonstrate their technical as well as economic feasibility for market acceptable global service.

Personalized information services by individually portable terminals is no doubt much more attractive than the services by plain wireline telephones or fixed terminals. Location oriented services by handset terminals which are expected to be globally available with global roaming provision will be another unique service menu of mobile internet for travelers .

By the time when the technical standards as well as international regulatory issues are resolved with universal consensus, the global e-commerce and universal information access service will be fully implemented via mobile internet service. For these reasons, wireless mobile terminals are predicted to occupy more than 70% of total internet terminals by 2010. In some countries, number of mobile subscribers has already surpassed that of wireline subscribers.

Statistics for market forecasts shows that 1.6 billion mobile terminals will be used in the world in 2010, creating 850 billion dollar industry market in mobile communication. Among them, Asia-Pacific will occupy 600 million mobile subscribers and 280 billion dollar market share.

Korea is currently enjoying heavy penetration rate of 50% in mobile service

subscription of 28million out of 45 million total population, reaching to 39million users in 2010..

2. Technical Hurdles for Mobile Service Evolution

Even with all those attractive merits of mobile communication services, due to its limited spectrum resource, the current 2nd generation digital cellular mobile service has many limitations in accommodating the multimedia internet services which are already available in the wire-line internet. With exploding growth of mobile subscribers, however, service providers have enjoyed revenue from voice-only service. Now, mobile operators are realizing that voice-only service will soon lose market and non-voice information service must be in the menue because growing number of wireline internet service providers are willing to offer voice service free of charge. Since the information services by either wireline or wireless internet terminals must be eventually compatible each other at the terminals, wireless internet has long way to go as far as the technical developments are concerned. Considering the size of mobile subsciption, the faster the technology development speed, the better for mobile internet prospect will be.

The 2.5 generation system which offers 144 kbps service may accommodate part of the wireline internet service menu while engineers struggle to catch up to 10-100 mega bps speed requirement and quality of service that are already available in the optical wireline counterpart. Already discussions are underway to prepare for 4th and 5th generation IMT-2000 in order to meet the interface requirements with terrestrial wireline.

With general anticipation that the IMT-2000 will be the dominant telecommunication service for the future mobile internet, recent licensing of 3rd generation IMT-2000 operators in Europe and Asian countries has turned out to be more or less a betting game(spectrum auction) for the exclusive market share for the future global internet, and marked a turning point toward the reverse direction to the era of monopoly. After they have acquired license by paying huge amount of cash, they have to wait for the time when the IMT-2000 service will be ripe in the market for the profit.

3. International Cooperation

Regardless it is wireline or wireless, if the future internet would be global and provide universal service, international cooperation is a prerequisite. Interoperability, service compatibility, terminal roaming, efficient traffic management of the global network, and universal access opportunity for developing countries, etc are major items which require international cooperation for the solution.

Back to top of page   **Back to the sessions page**

Seon Jong Chung

Dr. Seon J. Chung graduated from Seoul National University, Korea with BSEE in 1964 and received his doctorate degree in space communication in 1976 from the Pennsylvania Sate University in USA. He participated in the Space Shuttle Project in Johnson Space Center, Houston, Texas for 7 years as space systems engineer of Lockhhed Electronics and Ford Aerospace. Since he returned to Korea in 1983 to join ETRI, he managed KoreaÕs ISDN projects , then R&D projects for Koreasat as vice president of ETRI. He was promoted to the president of ETRI on April 1, 1998.

Also, he has been serving the president of Asia-Pacific Satellite Communications Council(APSCC) since 1994 to 1998.

Back to proceeding page **Back to the sessions page**

MITESH DESAI

Vice President, Marketing and Business Development
Compaq Telecom

Mitesh Desai, Vice President of Marketing and Business Development, Compaq Telecom, is responsible for managing the worldwide Marketing activities for Compaq's Telecommunications line of business. Mitesh provides leadership in shaping and driving Compaq's strategies, focusing in expanding Compaq's presence in the Service Provider space and developing partnerships with Network Equipment Vendors and Value Added Software Vendors. He was named to this position in August 2000.

Mitesh has over twenty years of communications industry experience. Before joining Compaq, he spent more than fifteen years at Nortel Networks where he most recently directed the strategic business development for their Emerging Service Providers segment, focusing on emerging Data Service Providers. Prior to this, he was based in Europe driving the product and business strategies to expand Nortel's presence in the Voice and Data Service Providers. During his tenure at Nortel Networks, Mitesh served in several other capacities with responsibilities including international marketing in Japan, Asia Pacific and Europe and the development of an Intelligent Networks software business strategy. He also led development teams in the design of communication systems, both at Nortel Networks and Siemens Communications.

Mitesh has an Engineering Degree in Computer and Systems Engineering and an MBA from Duke University.

Compaq Telecom

Public Relations - 408.285.9233

Speakers Bureau - 402.384.7220

1255 W. 15th

Suite 8000

Plano, Texas 75075

Tuesday, 16 January 2001
1100–1230

T.2.4 New Developments in Submarine Cable Technology

Location: Tapa I

Chair: Seiichi Tsugawa, Senior Deputy Director, International Strategy Dept., DDI, *Japan*

T.2.4.1 Large Capacity Submarine Cable System using DWDM Technology (ABSTRACT)

HITOSHI YAMAMOTO, Senior Managing Director; KOJI GOTO, Director; E. NAZUKA, Director; K. ASAKAWA; and HIDENORI TAGA, Deputy Director, KDD Submarine Cable Systems, Inc., *Japan*

T.2.4.2 Technology for Future Subsea Super-Highways (ABSTRACT)

TONY FRISCH, Director, Product Marketing, Alcatel Submarine Networks Division, United Kingdom

T.2.4.3 Latest Enabling Technologies for Terabit/s Optical Submarine Networks & Their Impacts on Performance & Cost (ABSTRACT)

KATSUTOSHI TAMURA, General Manager, Business Development, International Engineering, International Telecommunications Business Group; TATSUO MATSUMOTO, Senior Director, Submarine Telecommunications Engineering Division; and COLIN ANDERSON, Business Development Manager, Submarine Networks Sales & Marketing Department, International Telecommunications Business Group, Fujitsu Limited, *Japan*

T.2.4.4 Traffic, Services and Technology Drive New Approaches to Global Undersea Networks (ABSTRACT)

HOWARD D. KIDORF, Director, Services Engineering Division; WILLIAM C. MARRA, Senior Managing Director, Global Network Planning & Design; FRANK KERFOOT; and NEAL S. BERGANO, Managing Director, System Research & Selected Development, TyCom, *USA*

Large Capacity Submarine Cable System using DWDM Technology

Hitoshi Yamamoto, Koji Goto, E. Nazuka, K. Asakawa, and Hidenori Taga

Abstract

www.kddscs.co.jp

1. INTRODUCTION

An explosive growth of telecommunication traffic represented by the Internet strongly demands a large capacity submarine cable system with a short-term delivery. Following approaches are candidates of research and development to satisfy this traffic demand.

1. More fiber counts in the cable, such as 8 fiber pair or more.
2. Higher bit rate per channel, such as 40Gbit/s.
3. More channel counts per fiber pair, such as 96 Wavelength Division Multiplexing (WDM).

The increment of the fiber counts is fascinating, because it can be realized for the commercial application earlier than the other approaches due to its technological simplicity. On the other hand, this method raises the cable cost, and it is not favorable from the commercial point of view.

40Gbit/s based system is a quite attractive solution to provide more capacity, since economical advantages can be expected with less transmission equipment. Recently, 40Gbit/s transmission technologies are intensively investigated [1]-[2], and technical issues to realize 40Gbit/s system are being clarified. They are fiber dispersions, fiber nonlinearities, and so on. The fiber dispersions are major limiting factors of 40Gbit/s system. Therefore, new technologies to compensate for both the chromatic dispersion and the polarization mode dispersion will play important roles in the commercial application of 40Gbit/s system. As new technologies are not matured, development period is required. Then, it will take a long time to apply 40Gbit/s system for the commercial use.

10Gbit/s based WDM system is a promising candidate to meet both a traffic demand and a short-term delivery request since 10Gbit/s based WDM technologies have already been matured. In 10Gbit/s based WDM system, transmission capacity of the submarine cable system has been increased by the increment of WDM channels. The first generation 10Gbit/s based WDM system was designed to have 16 channels for long-haul transmission, and it came into service in year 2000. The second generation system has been developed to transmit 64 channels for middle-haul distance, and it is under construction. Then, 96 WDM system has been developed with the state-of-the-art WDM technologies, and it will be commercially available in year 2002.

This paper presents key technologies to increase number of channels at 10Gbit/s based system, and the next generation 96 WDM system is described with laboratory transmission test results.

2. KEY TECHNOLOGIES

Table 1 summarizes 10Gbit/s based WDM systems developed by KDD-SCS, which are named OSW-II, III, and IV, respectively. Channel counts of the latest system (OSW-IV) are 6 times as many as those of the first generation 10Gbit/s based system (OSW-II).

Table 1 WDM submarine cable systems developed by KDD-SCS

OSW-II	OSW-III		OSW-IV	
Long-haul (9000km)	Middle-haul (4000km)	Long-haul (7500km)	Middle-haul (4000km)	Long-haul (7500km)
16	64	32	96	96

In order to realize these systems, key technologies are an optical repeater, an optical fiber cable, and an optical transmission terminal. Detailed characteristics of these technologies are discussed below.

2.1 Optical repeater

Key parameters of WDM optical repeaters are a repeater output power, a noise figure, and an available gain bandwidth. High output power with low noise figure makes it possible to increase channel counts without decreasing optical signal-to-noise ratio. Wide bandwidth repeater decreases the transmission penalties due to the cross talk and the cross phase modulation between the WDM channels.

Figure 1 shows repeater output power and available bandwidth of OSW systems designed for long-haul transmission.

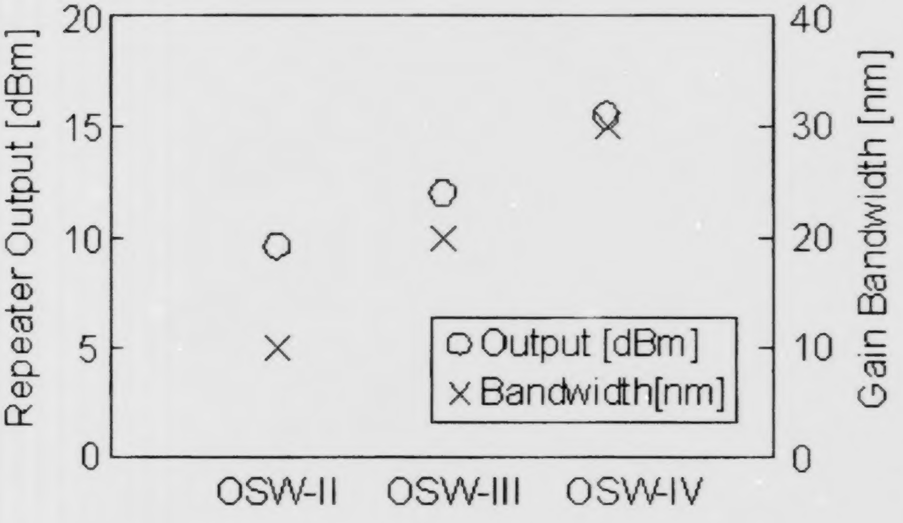

Figure 1 Output power and bandwidth of OSW family repeater

Although it is essential to use high output power pump Laser Diodes (LDs) to obtain high output power repeaters, available pump power is limited by not only the pump LD itself but also the other factors. For example, they are a bias current fed to the pump LD and a thermal radiation from the LD. In addition, the available gain bandwidth can be enlarged by optimizing a gain equalizer at an expense of the pump power. The use of 980nm pump LDs with redundant configuration is one solution to realize high output power, low noise figure, and wide gain bandwidth optical repeater. Figure 2 shows a schematic configuration of redundant pump LDs for the optical repeater.

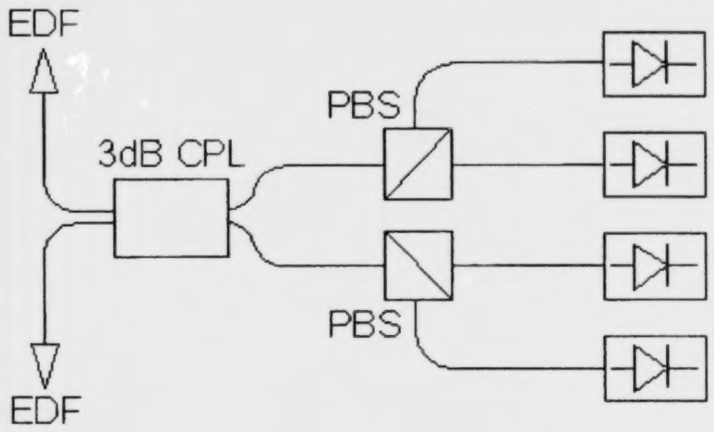

Figure 2 A schematic diagram of redundant pump scheme in the repeater

2.2 Optical fiber cable

Main technical issue for WDM cable is to decrease the transmission impairment due to the non-linearity and the chromatic dispersion of the optical fiber. To accomplish this, hybrid span configuration consisting of Large Core Fiber (LCF) and Low Dispersion Slope Fiber (LDSF) has been adopted in OSW-II system. LCF is adopted for high power portion and LDSF is adopted for small power portion, then, the first part of the span consists of LCF and the latter part of the span consists of LDSF. LCF has large effective area, and it is effective to reduce the transmission impairment due to the non-linearity of the fiber. LDSF has small dispersion slope, and it is effective to reduce the transmission impairment due to the chromatic dispersion of the fiber.

Even if a small chromatic dispersion fiber is used, the penalty related to an accumulated chromatic dispersion becomes dominant as number of channels is increased and/or transmission length is extended. Therefore, OSW-IV system for long-haul transmission adopts new hybrid span configuration consisting of Enhanced Effective area Positive Dispersion Fiber (EE-PDF) at high power portion and Slope Compensating Dispersion Compensation Fiber (SC-DCF) at small power portion [3]. As SC-DCF compensates both the chromatic dispersion and the dispersion slope of EE-PDF, the transmission impairment due to the accumulated chromatic dispersion can be minimized.

In addition, OSW-IV cable accommodates 8 fiber pairs, which can directly increase the cable capacity.

2.3 Optical transmission terminal

Narrow channel spacing device and signal processing technology are the major key factors of DWDM terminal equipment. OSW-III system adopts 0.3nm channel spacing, and the constraints are an optical demultiplexing device and a wavelength stability of the WDM signal. On the other hand, ultra-dense WDM transmission experiments using 0.25nm and 0.2nm channel separation have been reported [4],[5]. These papers have indicated the possibility of capacity expansion after a development of narrow channel spacing devices.

A Forward Error Correction (FEC) using Reed-Solomon [255,239] with 7.5 % overhead and 5.6dB coding Gain is widely applied for submarine cable systems. As 5.6dB FEC gain becomes a little small from the point of system requirement, novel FEC has been intensively studied with overhead of 20-28%. More than 7dB coding gain is reported with this kind of overhead [6]. However, the additional overhead increases the penalty due to the fiber non-linearity, and it requires higher speed electronics than the conventional FEC. Then, we have developed 7.5dB gain FEC with 14% overhead, and it was named as OSW Super FEC. OSW Super FEC uses a concatenated code of Reed-Solomon [255,239] and Reed-Solomon [239,223], and the overhead of this FEC is only 14%. Therefore, this code can be applicable to the long-haul optical fiber transmission systems with less transmission penalties than the other codes with 20-28% overhead. Figure 3 shows the capability of OSW Super FEC.

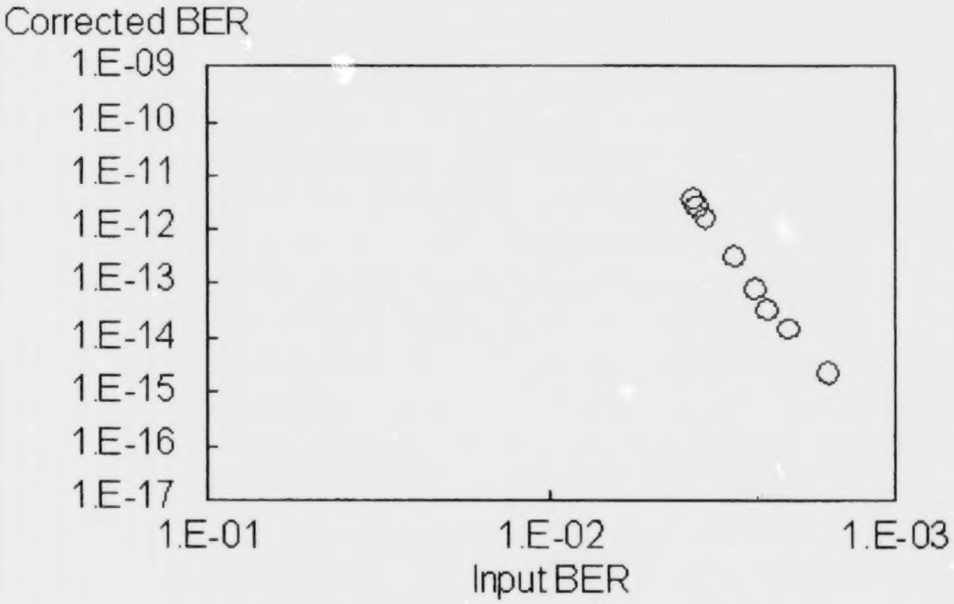

Figure 3 Capability of OSW Super FEC

3. OSW-IV SYSTEM

OSW-IV system is the latest and the maximum channel counts WDM system developed by KDD-SCS. Table 2 shows the design parameters of transmission line of the OSW-IV system.

Table 2 Design parameters of OSW-IV transmission line

Item	Middle-haul	Long-haul
Transmission Length	4000 [km]	7500 [km]
Bit Rate/Channel	11.4 [Gbit/s]	11.4 [Gbit/s]
Channel/Fiber Pair	96	96

Channel Spacing	0.3 [nm]	0.3 [nm]
Line Code	Binary RZ	Binary RZ
Repeater Span	45 [km]	40 [km]
Repeater Output	+14 [dBm]	+15.5 [dBm]
Repeater Input	+4.3 [dBm]	+6 [dBm]
Repeater Gain	9.7 [dB]	9.5 [dB]
Repeater Noise Figure	4.8 [dB]	4.5 [dB]
Span Configuration	LCF + LDSF	EE-PDF + SC-DCF

Transmission experiment has been conducted to confirm the validity of the line design using a circulating loop setup. Figure 4 and 5 show the interim test results for the middle-haul and the long-haul transmission, respectively.

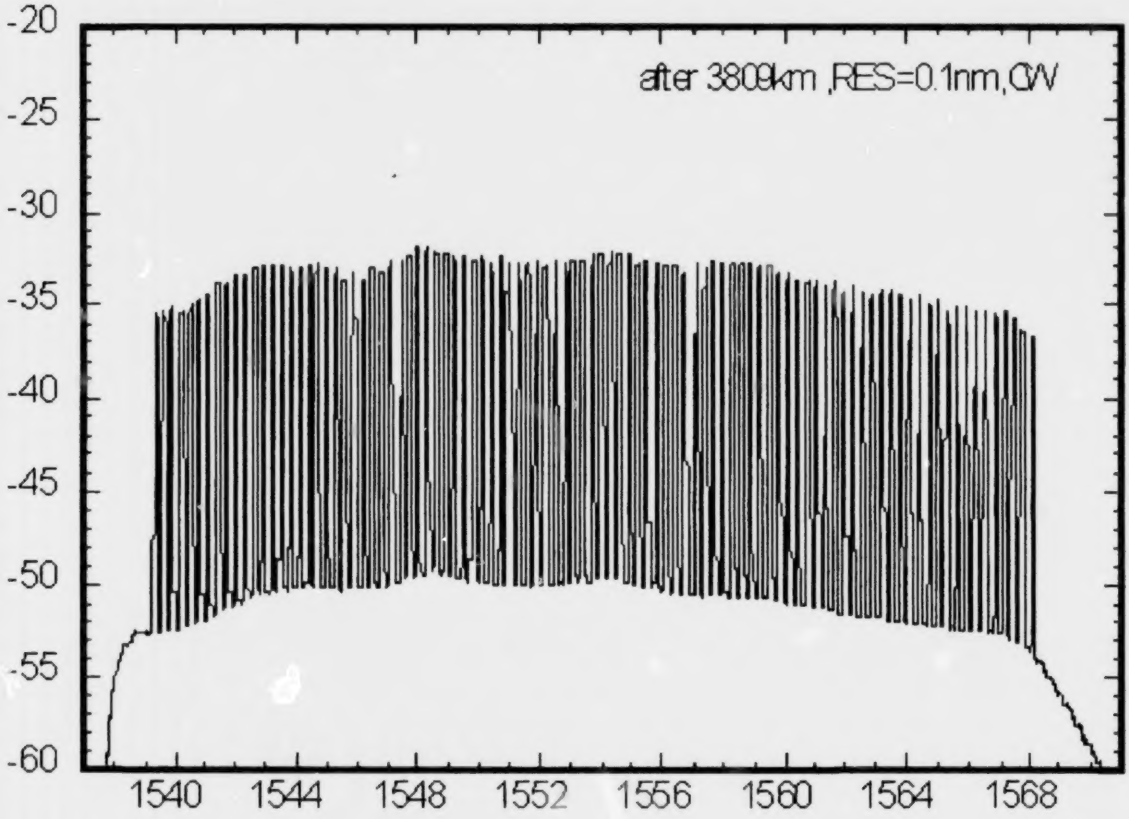

Figure 4 (a) Optical Spectrum after 3800km transmission

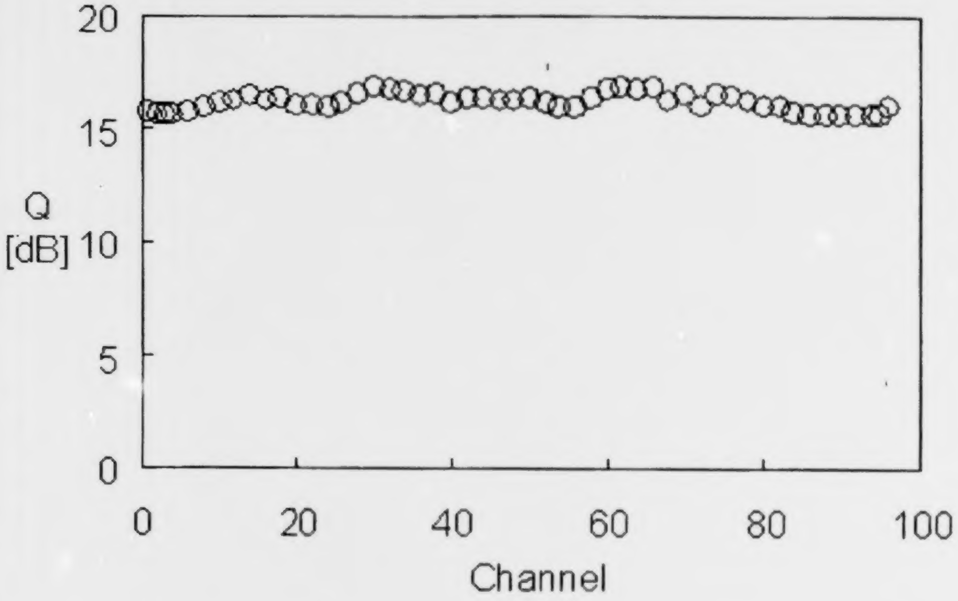

Figure 4(b) Measured Q-factor after 3800km transmission

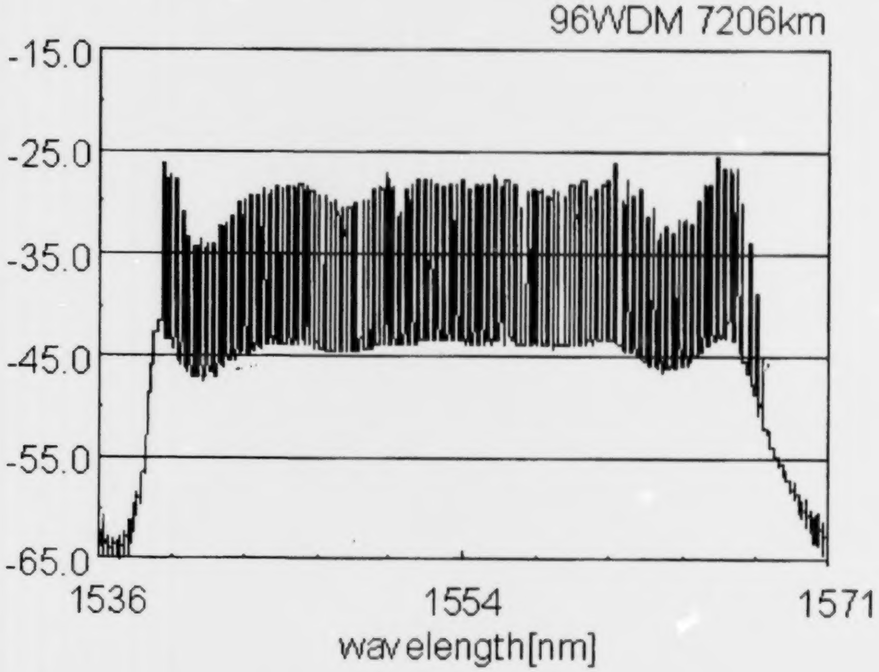

Figure 5(a) Optical Spectrum after 7300km transmission

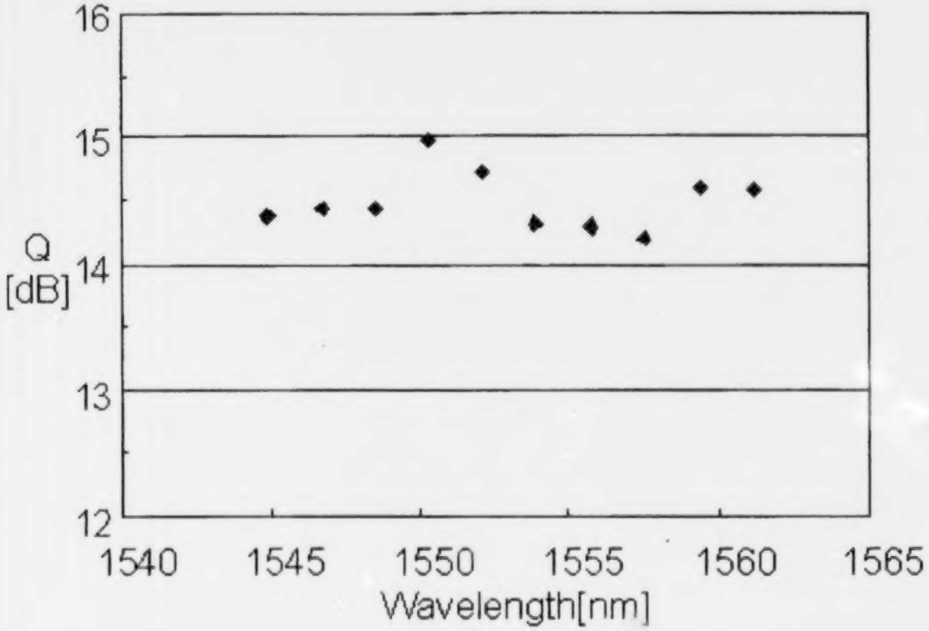

Figure 5(b) Measured Q-factor after 7300km transmission

The Q factors of 51 channels out of 96 channels have been measured for the middle-haul transmission experiment. 10 channels out of 96 channels have been selected to investigate the transmission performance for the long-haul transmission performance. Judging from the measured channels, required Q performance for the commercial submarine cable systems can be met based on this system design.

4. CONCLUSION

We have successfully developed 10Gbit/s, 96 channels transmission system using high output power, low noise figure, and wide bandwidth amplifier with 980nm high power pump LDs and hybrid span configuration to reduce the degradation by the non-linearity and the chromatic dispersion of the optical fiber. OSW Super FEC having 7.5dB gain will not only protect the transmission performance against the degradation due to aging and repair of the wet plant but also improve the productivity of both the dry plant and the wet plant by relaxing their technical specification.

5. ACKNOWLEDGEMENT

The authors are grateful to Mr. K.Iwasaki, Drs. Y.Niiro, S.Akiba, and Y.Matsushima for their steady encouragement and supports for this research and development. They would also like to thank staff of KDD R&D Laboratories and KDD-SCS Shin-Yokohama Laboratory.

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Back to top of page **Back to the sessions page**

Hidenori Taga

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Hidenori Taga was born in Kanda, Tokyo, Japan on April 24, 1962. He received the B.E. and Dr. Eng. degrees in electronics engineering from the University of Tokyo, Tokyo, Japan in 1986 and 1998, respectively.

In 1988, he joined Kokusai Denshin Denwa (KDD) R&D Laboratories, Tokyo, Japan, where he had engaged in research of undersea optical fiber communication systems employing optical amplifier repeaters.

In 1998, he moved to KDD Submarine Cable Systems Inc., Tokyo, Japan, where he has been engaging development of undersea optical fiber communication systems using wavelength division multiplexing technology.

Dr. Taga is a member of Institute of Electronics, Information, and Communication Engineers in Japan.

Back to proceeding page **Back to the sessions page**

Technology for Future Subsea Super-highways

Tony Frisch

Abstract

www.alcatel.com/submarine/index.htm

1 Trends in subsea systems

Driven by factors such as deregulation of telecommunications and the growth of the Internet (and the applications used on it) the demand for transmission capacity has increased in a dramatic fashion in recent years. Cables currently under construction will offer a few Tbit/s (1 Tbit/s = 1000 Gbit/s), but there is pressure for even more. At the same time there is more focus on economic aspects (overall cost per Gbit/s) and practical issues such as the size and consumption of equipment.

This paper examines some of the issues involved, attempting to consider economic and operational features as well as the obvious question of what are the limits to transmission capacity.

2 Capacity

The obvious ways to increase transmission capacity are:

- Higher line-rates
- More wavelengths
- More efficient transmission formats i.e. more bits per Hz
- More fibers

2.1 Higher line-rates

In the first 2.5 Gbit/s systems signals were spaced at 100 GHz (roughly 0.8 nm), the spacing being limited by the filters then available. Today's 10 Gbit/s signals are spaced at 50 GHz (0.4 nm), thus allowing 8 times the capacity for a given bandwidth.

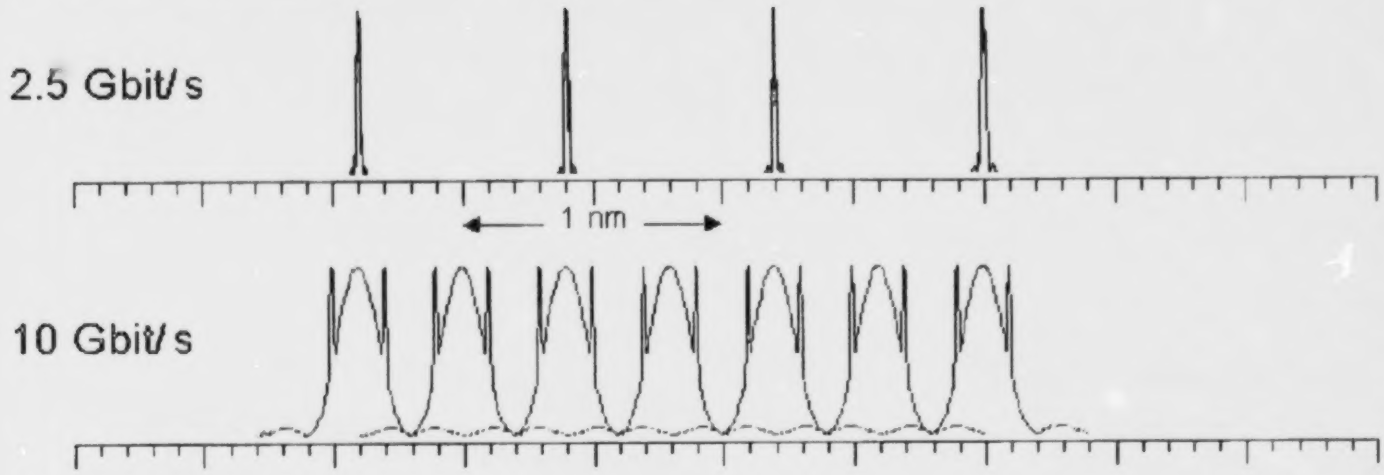

Fig. 1. Spectra of 2.5 and 10 Gbit/s WDM signals

Will an increase to 40 Gbit/s yield a further 8-fold improvement?

Sadly not. A Return to Zero (RZ) binary signal at 10 Gbit/s has a spectrum of around 40 GHz width, thus requiring that it be spaced about 40 GHz from the next wavelength. Any less and there is some overlap of the two spectra which leads to penalties; for a small overlap these may be acceptable, but this nonetheless sets the limit, which is probably not much less than the current spacing of 50 GHz - 35-40 GHz seems a likely minimum spacing. At 40 Gbit/s the same problem occurs, limiting the spacing of signals to 120-140 GHz, which gives no more capacity than a system based on 10 Gbit/s per wavelength.

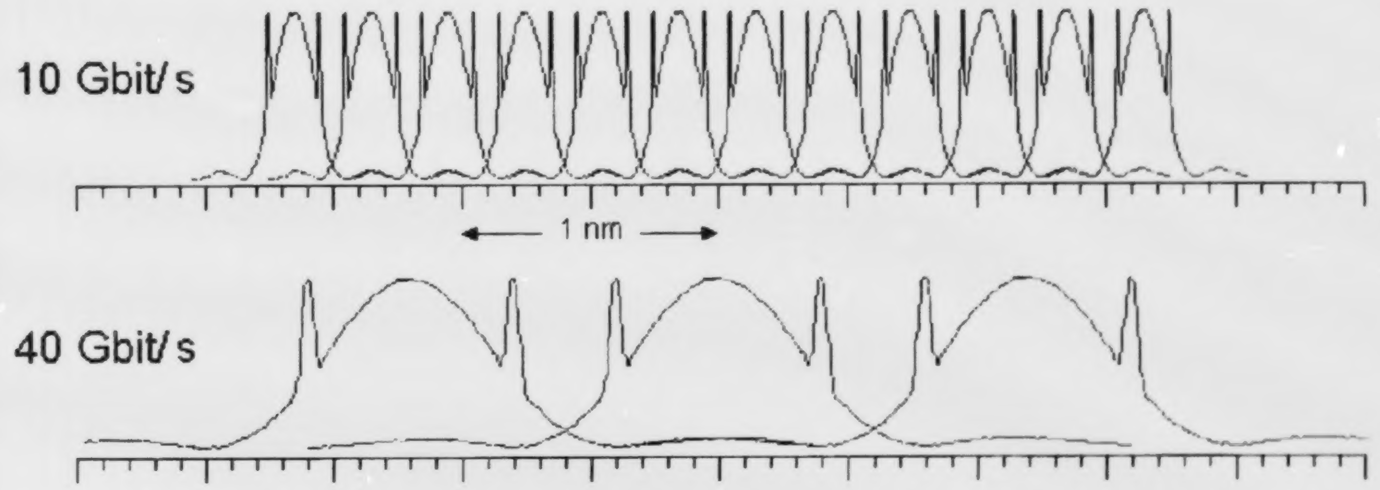

Fig. 2. Spectra of 10 and 40 Gbit/s WDM signals

Ultimately, 40 Gbit/s should offer benefits in compactness and overall system cost. At present most of the Submarine Line Terminal Equipment (SLTE) consists of the units for each wavelength, which include traffic interfaces (input and output), FEC (coding and decoding), wavelengths source, high-speed modulation, receiver and various support modules. Increasing the line-rate from 10 Gbit/s to 40 Gbit/s would reduce the number of these units by a factor of four. Although individually the higher speed units will be more expensive to make and will take more space, the overall assembly should be less expensive and more compact. This potential will, however, not be realized while 40 Gbit/s equipment uses 10 Gbit/s interfaces (the case for the first generation of equipment) since each unit will have to supply multiplex and de-multiplex units.

2.2 More wavelengths

A technique widely discussed in research papers is to use the L-band of the Erbium-doped Optical Amplifier (EDFA) as well as the C-band, thus roughly doubling the bandwidth. At present, however, one needs different doping levels for the L and C-bands, effectively requiring an amplifier for each band.

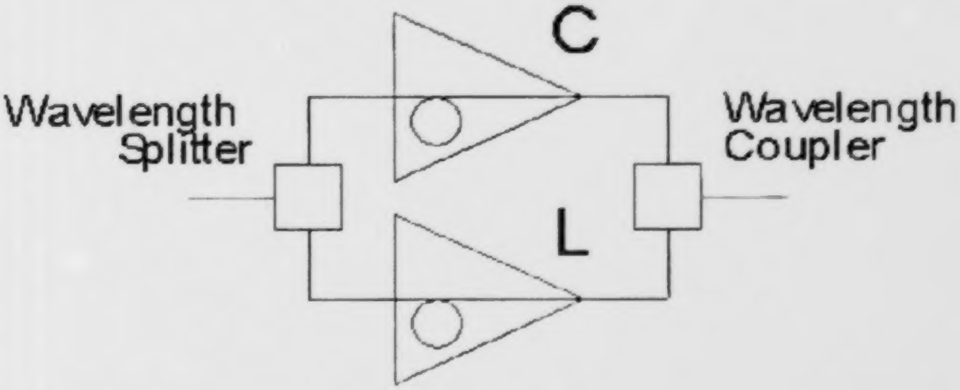

Figure 3. C+L band amplifier - simplified schematic

This solution is not ideal, as it introduces the need for a wavelength splitter and coupler - which must have a small effect on reliability - but also the composite amplifier will be more than 2x the size of a simple amplifier and will also consume more power. It's also likely to cost roughly twice as much to produce since its complexity and component count are roughly doubled. It's one benefit is that it allows the fiber to carry twice the traffic, but in submarine systems the fiber is a very small cost element; a system with twice the number of C-band amplifiers and more fiber would sound like a better economic choice.

An interesting alternative could be the use of Raman amplification, where the amplification occurs in the line fiber before the repeater, which is excited by a number of Raman pumps in the repeater.

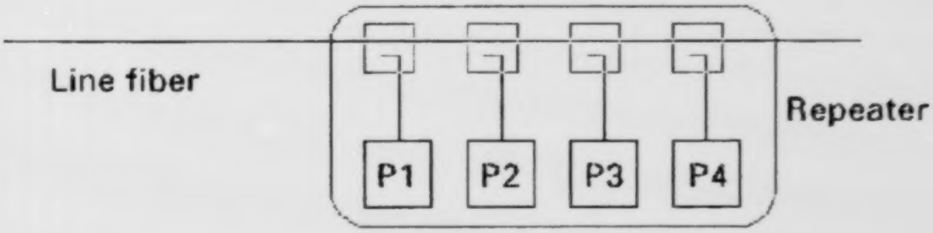

Figure 4. Raman-based amplifier - simplified schematic

This scheme has the benefits of relative simplicity, but requires several high power pumps to achieve the required performance. In general, submarine systems have not yet used Raman amplifiers, except in unrepeatered systems; this is mainly due to the high pump power needed for Raman amplifiers compared to those based on Erbium-doped fibers.

2.3 More efficient transmission formats / modulation schemes

Current 10 Gbit/s systems use 50 GHz per wavelength - an efficiency of 0.2 bits/Hz. One solution to increasing system capacity could be to find transmission formats which are more efficient.

Non Return to Zero (NRZ) transmission in fact uses half the bandwidth of RZ and might seem a promising candidate, but in transmission it produces penalties of around 2 dB. Multi-level codes offer a similar potential; a four level code halves the bandwidth requirement, but requires a 5 dB increase in mean received power - it also poses significant processing difficulties at high speeds.

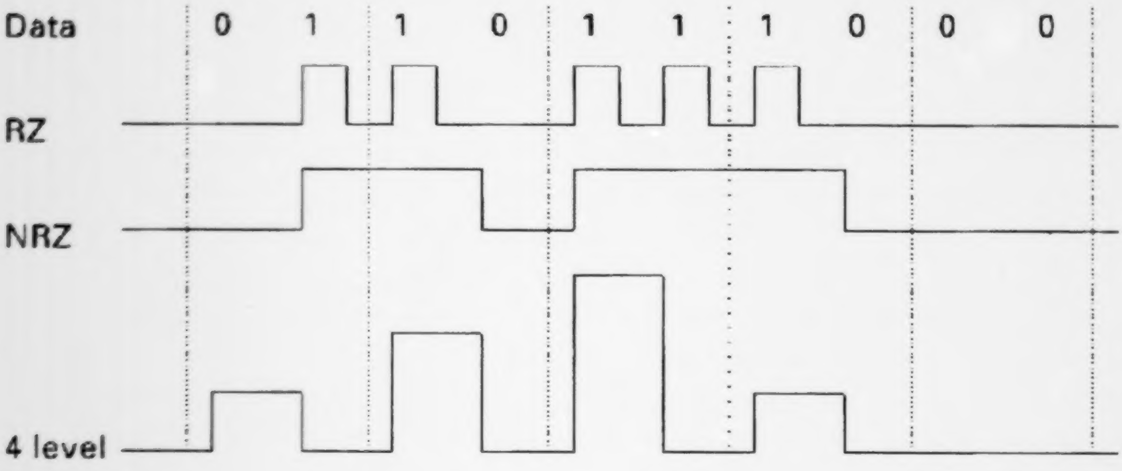

Figure 5. Different signal formats

(The four level code takes pairs of bits and produces a signal level proportional to the binary level i.e. 00 = 0, 01 = 1, 10 = 2, 11 = 3.)

While these simple examples have obvious problems, there are other possibilities, including those where phase or frequency is modulated instead of, or as well as, amplitude. While most of these schemes will not be simple to implement at 10 Gbit/s or higher, the prospect of increasing system capacity - maybe by a factor of two - makes them an interesting option.

2.4 More fibers

Increasing the capacity by adding more fibers represents a very simple solution; it poses no complicated transmission issues, but it does require the cable and repeater to accommodate the extra fibers and their amplifiers. To a large degree these are mechanical questions; in particular, increasing the number of amplifiers will clearly increase the weight and volume of the repeater, unless the amplifiers can be made more compact and light. If the repeater weight is increased, then the cable strength will (at some point) need to be increased to ensure successful deployment and the possibility of recovery.

Each extra fiber, however, adds an extra amplifier pair to all the repeaters, which in turn adds to the power that has to be supplied. Supplying extra power requires either extra voltage or lower cable resistance, or both - increasing the current increases the system voltage unless the cable resistance is reduced.

Significant voltage increases pose the problem of re-designing all the submerged plant to tolerate the higher voltage; in some cases (e.g. repeaters) it may not be easy to increase the thickness of the electrical insulation without making it more difficult to get rid of heat.

Decreasing cable resistance would seem to be the obvious solution, but this is less easy than it seems. Much of the power-feed current flows in the copper part of the cable. Increasing the amount of copper in the cable would reduce its electrical resistance, but also increases the weight without significantly improving strength. Since increasing the number of pairs make the repeater heavier, a heavier cable is doubly unwelcome, as it reduces the depth of water in which the repeater can be recovered. The problem isn't insoluble, one might imagine using low resistance cable in the shallower parts of the system, but it's clear that significant increases in the number of fibers will pose a serious challenge for long systems.

3 Power as a limiting factor

Unlike land systems, where power is relatively unlimited, submarine systems have to be powered via the cable, the resistance of which is hard to reduce. Current systems will tolerate up to around 10 kV - implying a total end-to-end voltage of 20 kV - but it's clear that there are some practical limits which are not much higher than this; even doubling the voltage would seem out of the question today. So what implication does this have on system capacity?

Since the repeater power is shared between all the wavelengths, increasing the number of channels requires a proportional increase in power. Going to a higher line-rate doesn't help, as the shorter pulses have lower energies; again, the power needs to be increased. As a first approximation, the power needs to increase with the total system capacity, whether the capacity is changed by adding wavelengths, by changing line-rate, or by increasing the number of pairs. To produce more power at the amplifier output clearly requires more power from the pump devices, This argument suggests that the amplifier input power needs to increase in rough proportion to the system capacity, whether the capacity is increased by adding wavelengths or fiber pairs or by increasing the line-rate.

One might at first think that changing the repeater spacing is a solution to this problem. Say one wishes to quadruple the capacity; one reduces the repeater separation by 6 dB and one now has the required power at the repeater input. This means, however, that the number of repeaters has increased; if we assumed an initial span of 12 dB (roughly correct for today's systems), then the total number of repeaters is doubled, which gives two times the accumulated noise and a significant increase in non-linear penalties, as there are now more regions with high power. Achieving the required signal to noise ratio will need either more power or a further reduction in the repeater spacing. In either case the total system power consumption rises. While this explanation of propagation impairments is over-simplified it illustrates that unless something fundamental changes, the power needed for a given system length will increase roughly in proportion to it's capacity. The following graph shows the system voltage for different capacities and lengths.

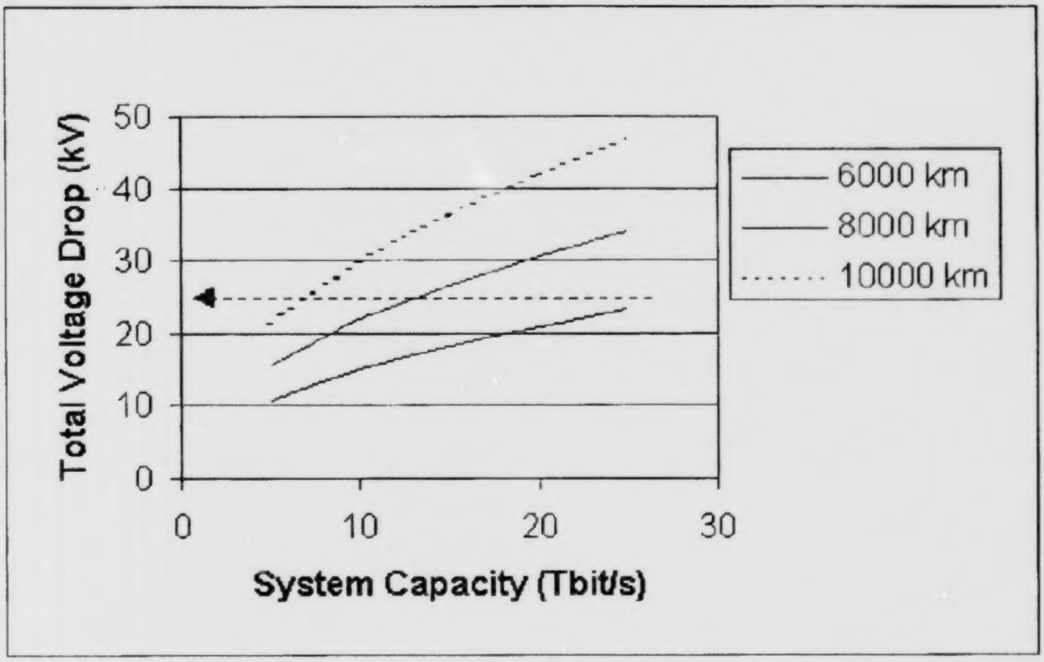

Figure 6. System voltage v. capacity

The graph is based on a cable resistance of 0.7 ohm/km and assumes a consumption of 6 Watt/amplifier. It also assumes that the line current is chosen to minimize the total voltage, so it might be considered somewhat optimistic. Does this graph show the limit to capacity?

In recent years there has been enormous effort devoted to Erbium-doped fiber amplifiers and all their associated components. Amplifier output has increased by 2-4 times, while system current has reduced slightly. Can this continue? Consider first the conversion of electrical power into optical power; the most powerful submerged amplifiers produce around 20 mW, but consume over 2 W of electricity - a conversion efficiency of around 1%. The reason for this low value is that firstly the electricity has to be converted to optical pump power and then the pump power is converted into signal power. For both processes there are some serious constraints, but this is an area where we might expect to see further improvements.

4 Other practicalities

The earlier sections have discussed some of the technical issues associated with increased capacity. While there are some significant challenges, there are no fundamental reasons why capacity cannot be further increased. Technical issues, however, are not the only ones that need to be considered.

4.1 Economics

So far it's always been assumed that increasing capacity is the route towards a lower cost per unit capacity. As long as there are fixed costs associated with a cable system, then clearly this is essentially true, but the benefits get smaller and smaller. The following graph shows the relative costs of 6000 km system with different numbers of fibers, each equipped for 68 x 10 Gbit/s.

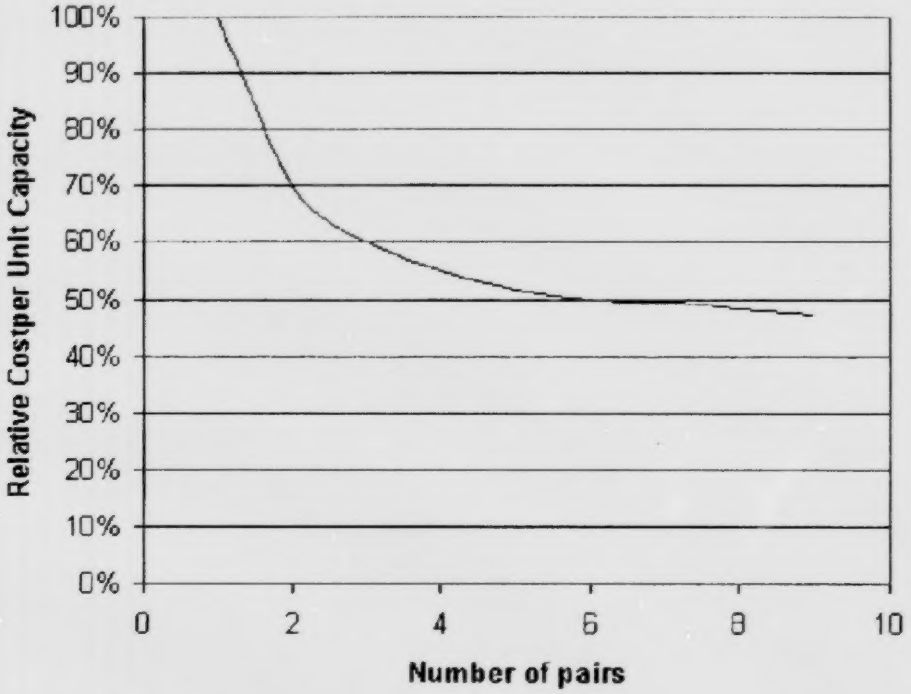

Figure 7. Relative cost v. fiber pairs

After a rapid fall the cost per unit capacity begins to flatten and there is relatively little benefit in pressing beyond around 8 pairs. Indeed one could produce some arguments for lower numbers of fiber pairs.

- The figures for cost per unit capacity will be significantly larger if the capacity isn't equipped; so buying capacity that isn't used can affect the economics.
- Buying a smaller cable leaves open the possibility of buying a more advanced cable later, although this may be an option only once one already has two cables. Two small cables cost only a little more than one big one, and the deferred purchase clearly offers a benefit in terms of cash-flow costs, as well as the possibility of benefiting from technical advances.

There are equally some reasons to consider larger numbers of fibers.

- In a consortium-owned cable it may be convenient/necessary to have one or more pairs per owner and the same argument would apply where the intent is to sell fiber pairs.

4.2 Network aspects

Buying a cable with huge capacity presents a restoration problem, although this may become a serious issue only as the cable capacity is filled. Nonetheless, there is an argument for more small cables, where a break has a lower impact. Multiple cables offer the potential for greater efficiency - with two equal cables 50% of the capacity is needed to cover the possibility of a break: with three only 33% is needed, while four requires only 25%. Clearly there are other factors to consider e.g. in some cases overcrowding may make it difficult to install extra cables, but where it is possible, there is a good case for several smaller cables.

5 Summary and conclusions

There are a number of evolutionary steps that can increase transmission capacity. Extending the C-band and reducing the separation of 10 Gbit/s channels together could give more than 50% increase in capacity per fiber. Exploiting the L-band could add a further significant capacity, but unless a single amplifier can handle both bands it will be more complicated and expensive; in which case there are probably better solutions.

The present spacing of 10 Gbit/s wavelengths is such that only a modest reduction can be made before the theoretical limit is reached. This means that increasing the line-rate (for example to 40 Gbit/s) will not increase system capacity because the higher rate signals will need larger separations. A solution could be the use of modulation techniques to reduce the bandwidth of the signals; although most of these will be hard to apply at high speeds they offer the potential for increases from our current spectral efficiency of 0.2 bit/s/Hz. Nonetheless 40 Gbit/s is the next step in the hierarchy and in the long term we should see gains in the compactness and cost of equipment at this rate.

Adding extra fibers is an obvious way to increase capacity, but it has impacts on the mechanical design of the cable, which would need to support a heavier repeater. The extra amplifiers will require extra power, and it's generally the case that as the capacity of a system is increased - no matter how - there is an increase in its power consumption. At the same time there has been good progress in reducing the consumption of amplifiers and further improvements are likely. Interestingly, there seem to be economic and networking arguments against increasing the number of fiber pairs beyond 8.

Finally, it's important to realize that despite the challenges described here, there are positive reasons to believe that the capacity will keep increasing. Beyond the current evolution, there are new technologies which may change the direction of development.

Back to top of page **Back to the sessions page**

Tony Frisch - Director of Product Marketing.

After a first degree in Physics, Tony worked in the research labs of British Telecom for several years, where he acquired a Masters degree in Telecommunications. He then spent a few years in Alcatel Australia handling the testing and commissioning of submarine systems. Following this he worked for Bell Labs, designing terminal equipment in the US, before moving back to Alcatel Submarine Networks in France, where he has made a gradual move towards the commercial world, while still keeping his interest in technology. He is currently in charge of Product Marketing for Alcatel Submarine Networks.

Back to proceeding page **Back to the sessions page**

Latest Enabling Technologies for Terabit/s Optical Submarine Networks, & Their Impacts on Performance & Cost

Katsutoshi Tamura, Tatsuo Matsumoto, Colin Anderson

Abstract

http://www.fujitsu.co.jp/en/

http://www.fujitsu.co.jp/hypertext/Telecom/

1. Introduction

At PTC2000 we presented a paper entitled "*Terabit Optical Submarine Networks - Meeting the Market's Capacity Demands at the Lowest Overall Cost*" in which we identified the enabling technologies for high-capacity long-haul international submarine networks, and evaluated their impacts on the cost of several network models, for example over 2,000 km and 8,000 km with varying traffic capacities.

The demand from the marketplace for "more capacity" together with "reduced cost per bit" has continued, and is stronger than ever. The international submarine cable market has historically been a cyclical one, with periods of high demand followed by periods of low activity. However, over the past few years we have experienced unprecedented demand for new systems, driven primarily by real and forecasted traffic demand arising from growth of the Internet.

In this period, submarine network suppliers have dedicated much effort and resource to developing new systems with higher capacity, lower costs, and ever shorter installation periods, yet without sacrificing other characteristics such as ultra-high reliability, or maintenance costs.

2. Enabling Technologies

The following is a summary of the latest developments in enabling technologies for long-distance ultra-high capacity optical submarine networks.

Advances in Advances in Erbium Doped Optical Amplifiers (EDFA)

EDFA Optical Amplifier Band-width & Amplitude Response

In the past few years, R&D into Erbium Doped Fiber optical amplifiers (EDFA) has led to practical EDFA for application in submarine repeaters with usable band-width in the C-Band increasing from approximately 8 nm in 1996 to over 30 nm in 2000.

In 1999 and 2000, significant advances in EDFA design have also proven their practical application in the optical L-Band, with usable band-width of over 30 nm in this band too.

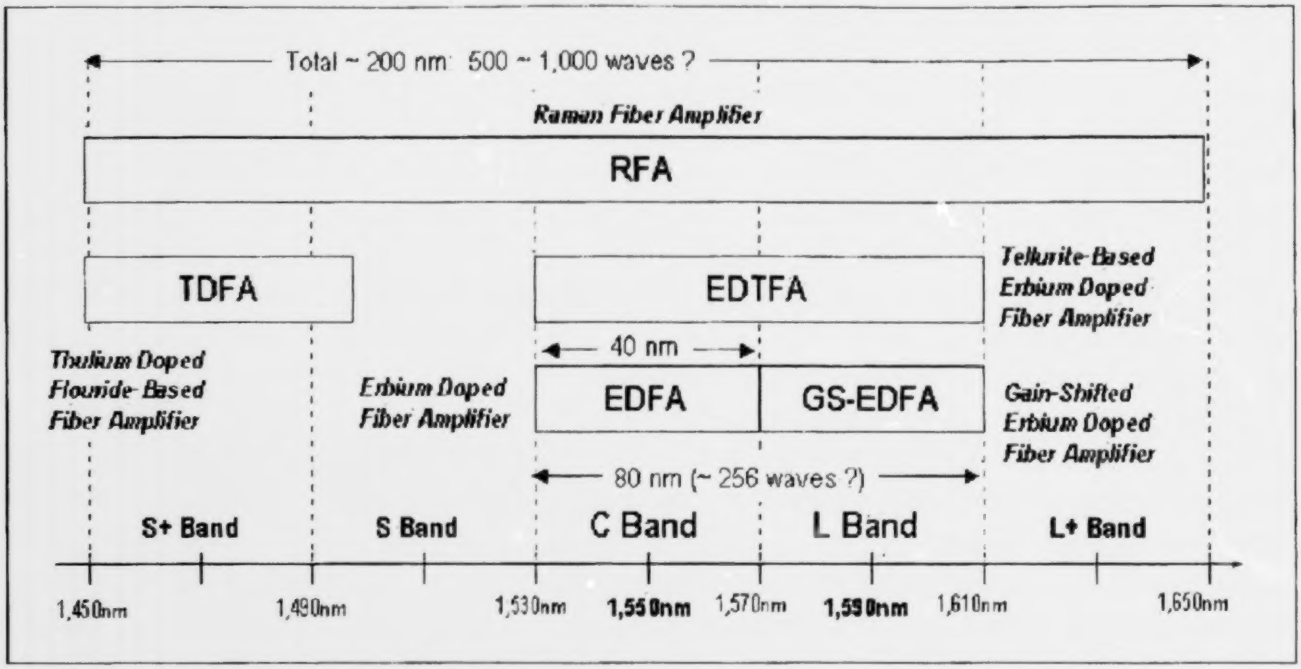
Total ~ 200 nm: 500 ~ 1,000 waves ?
Raman Fiber Amplifier
RFA
TDFA
EDTFA
Tellurite-Based Erbium Doped Fiber Amplifier
40 nm
Thulium Doped Flouride-Based Fiber Amplifier
Erbium Doped Fiber Amplifier
EDFA
GS-EDFA
Gain-Shifted Erbium Doped Fiber Amplifier
80 nm (~ 256 waves ?)
S+ Band
S Band
C Band
L Band
L+ Band
1,450nm
1,490nm
1,530nm
1,550nm
1,570nm
1,590nm
1,610nm
1,650nm

Figure 1: Available Optical Spectrum

Channel Spacing, Total Number of Channels, Total Capacity

Over the past few years, we have been able to reduce the spacing between WDM form around 1 nm to 0.3 nm for 10 Gb/s line rate per channel.

Using RZ modulation, we may be able to reduce the channel spacing to 0.25 nm with 10 Gb/s line rate, however significant penalties occur of we try to reduce the channel spacing to 0.2 nm.

By applying reduced channel spacing together with larger amplifier band-width, we have been able to increase the number of channels from around 8 channels in 1996 (8 waves x 1.0 nm = 8 nm band-width) to over 100 channels in 2000 (105 x 0.3 nm = 31.5 nm band-width). The measured performance of a practical 105 wave x 0.3nm spacing optical Multiplexer / de-Multiplexer device is shown in Figure 2.

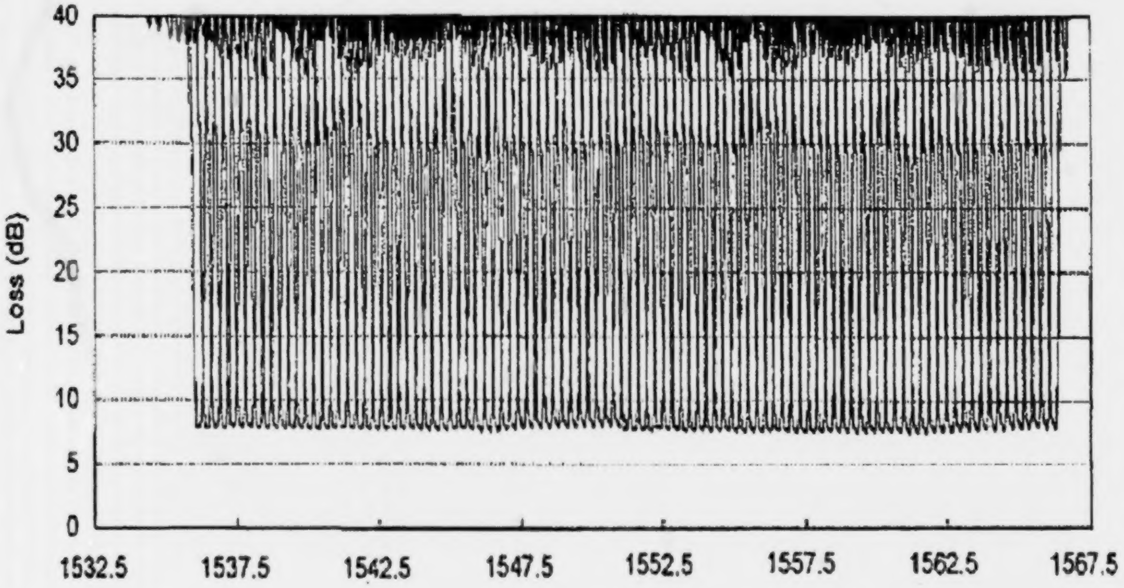

Figure 2: Performance of a Practical Optical MUX / De-MUX (105 channels x 0.3nm)

Overall Impact Including Line Rate Increase

If we also take into account the move form 2.5 Gb/s line rate to 10 Gb/s line rate in 1999, then the capacity per fiber achievable with practical WDM submarine systems using C-Band and EDFA has risen by over 50 times, from

2.5Gb/s x 8 = 20 Gb/s to 10 Gb/s x 105 Gb/s = 1,050 Gb/s = 1.05 Tb/s

Together with an increase in number of optical fibers per cable from 2 or 4 up to 8, we have achieved spectacular growth in the capacity per cable as shown in Figure 3.

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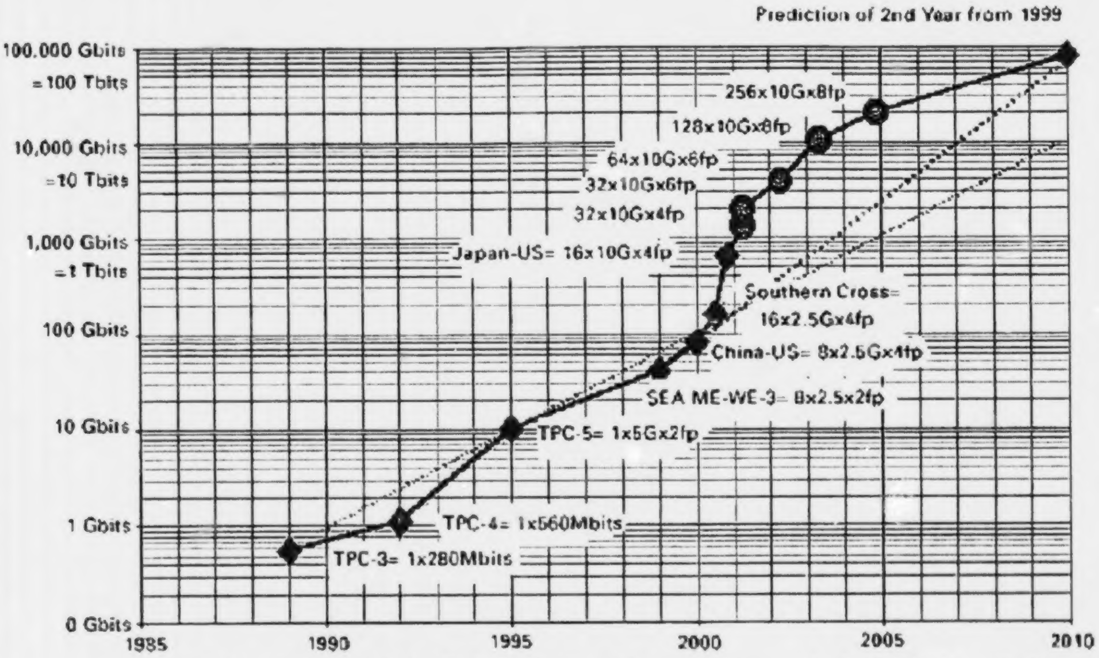

Figure 3: Submarine Cable Capacity vs Time, Actual & Prediction

EDFA Optical Amplifier Pumping Technologies

Early EDFA's for submarine application utilised only backward pumping of the erbium doped fiber, typically with 1,480 nm pump lasers. Later systems utilised both forward and backward pumping techniques, with 1,480 nm pump lasers for the backward pumping, and 980 nm pump lasers for the forward pumping.

There were many factors involved in the selection of these pumping architectures, including price, reliability and commercial availability of suitable 980 nm pump lasers.

The recent trend is to utilise only 980 nm pump lasers, in forward pumping mode, as shown in Figure 4.

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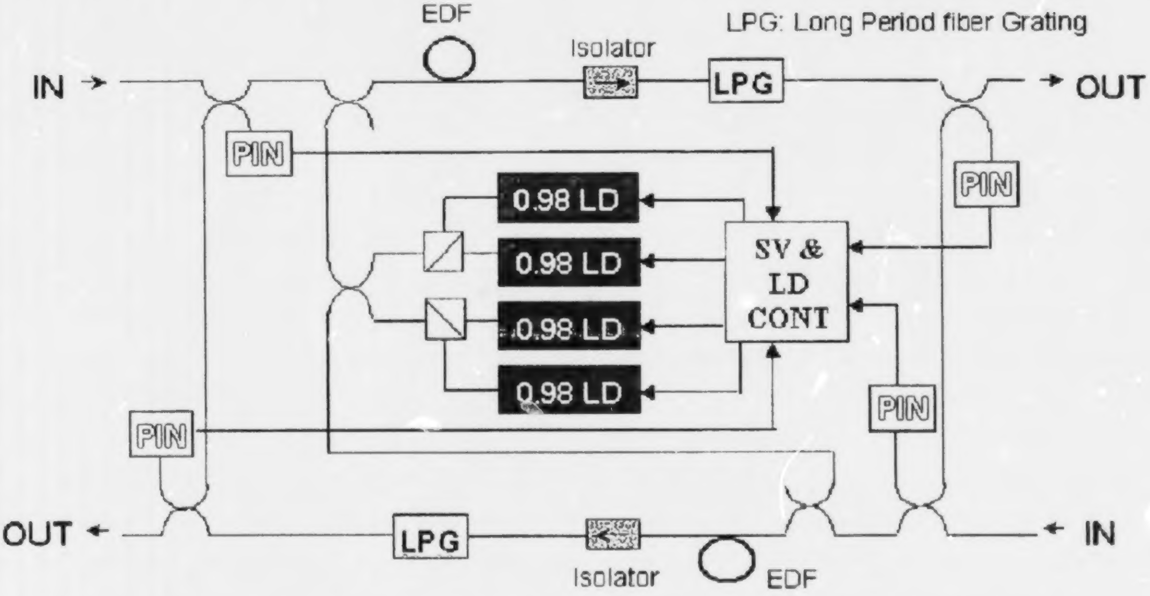

Figure 4: Repeater Configuration for Erbium Doped Fiber Amplification

Optical Amplifier Noise Figure

The use of only 980 nm pumping lasers in forward pumping mode has contributed to a significant reduction in the Noise Figure of the EDFA, from around 6.5 dB to around 4.5 dB.

Optical Output Power

Advances in pumping lasers, particularly 980 nm pump lasers, have produced commercially available devices from a number of manufacturers, which exhibit high output power, high efficiency, high reliability, and reasonable cost.

Advances in Optical Fiber for Transmission Spans

Non-Linear Effects / Fiber Effective Area

The most serious degradation in performance of very high capacity long-haul dense WDM optical systems with concatenated EDFA's is due to non-linear effects, primarily Cross-Phase Modulation (XPM), Self-Phase Modulation (SPM) and Four-Wave Mixing (FWM).

These effects can be minimised by reducing the optical power density in the fiber - either by reducing the input power, or by increasing the "Effective Area" (Aeff) of the optical fiber.

Reducing the input power is difficult, because it would decrease the repeater spacing, with a big resultant increase in system price. On the contrary, one of our main aims is to increase the repeater spacing to minimise system cost.

Dispersion Compensation & Dispersion Slope

Using optical fibers with positive and negative values of chromatic dispersion, we can always make the overall dispersion of the system zero at a specific wavelength (usually a wavelength near the center of the transmission band).

But a major factor causing degradation of the optical signals is the "Dispersion Slope" of the transmission fiber. That is, the difference in dispersion as a function of wavelength. When the overall dispersion slope is non-zero, we can make the overall dispersion zero for a specific wavelength (as stated above) but the overall dispersion for most or all other wavelengths will still be non-zero, as shown in Figure 5.

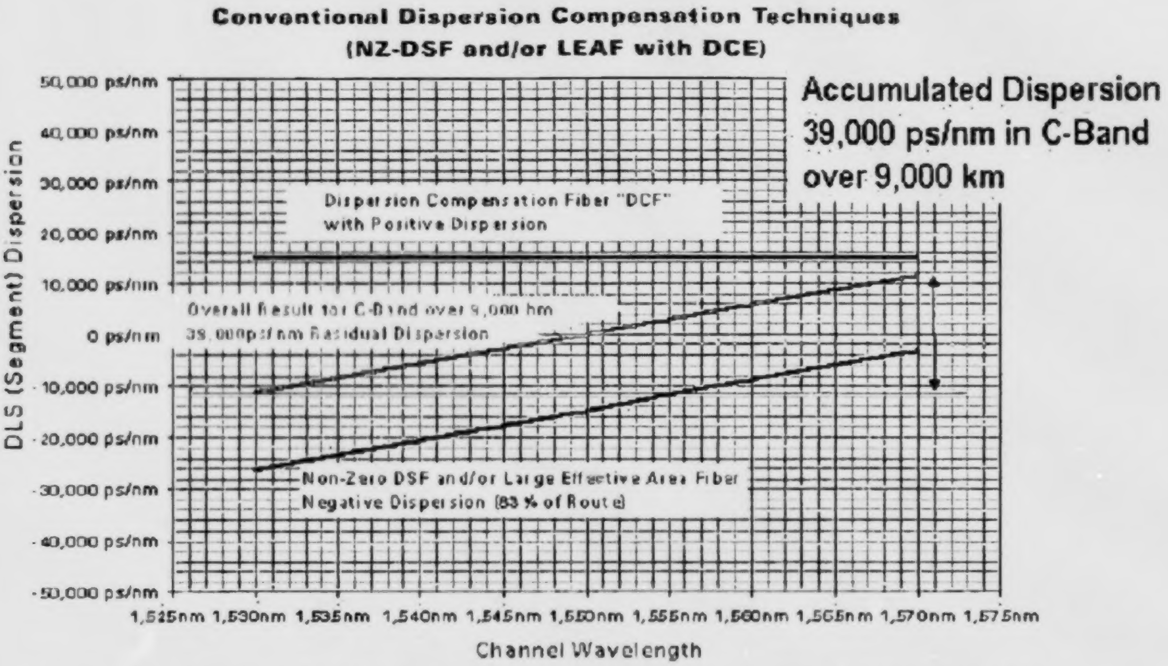

Figure 5: Dispersion vs Wavelength for Conventional Optical Fibers

The Dispersion Slope of conventional Non-Zero Dispersion Shifted Fibers (NZ-DSF), including "Large Core" or "Large Effective Area" versions of these fibers widely applied in submarine networks, causes two serious problems.

Firstly, we need to do dispersion compensation at the terminal stations on a channel-by-channel basis, since the accumulated dispersion is so large between the edge and center channels. This is possible, but is space-consuming and expensive to achieve.

Secondly, although each WDM channel is centred on a specific wavelength, the signal is amplitude-modulated and so occupies a real (non-zero) band-width. If the transmission cable has dispersion slope, then the lower frequency and higher frequency components of a single WDM channel will experience dispersion due to Group Velocity Delay (GVD) differences. This results in significant pulse distortion, and will be a much more serious problem for future higher bit rates such as 20 Gb/s and 40 Gb/s.

Attenuation

In order to make the repeater spacing as large as possible, we also seek to keep the fiber attenuation as low as possible.

Proposed Next Generation Fiber Schemes

A solution to the dispersion slope issue seems unlikely to be possible using a single optical fiber type. If a fiber could be fabricated with zero dispersion slope, then other parameters of such a fiber would almost certainly make it impractical for use in real systems.

The most popular approach at present, and which has received much R&D attention in the past 2 years and currently seems to have good support from both fiber manufacturers and system suppliers, is the use of two separate optical fibers in each inter-repeater span of the systems.

Approaches using three types of fiber have also been suggested, but this further adds to complexity and cost, and very good results have been shown to be achievable with two fiber types. Such schemes are described as use of Reverse Dispersion Fiber (RDF), Inverse Dispersion Fiber (IDF), or "+D / -D Fiber" by different companies.

It may seem logical to choose two fiber types with opposite characteristics, and to apply them in equal lengths in an inter-amplifier span. For example 25 km of "type A" fiber and 25 km of "type B" fiber in each 50 km span, where the nominal dispersion of type A is positive (say +18 ps/nm/km), the nominal dispersion of type B is negative (say -18 ps/nm/km), and the dispersion slope of the two types also is equal and opposite, so cancels out and results in zero overall dispersion slope.

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Schemes with equal lengths of positive and negative are possible, and are being promoted by some suppliers. The term IDF is most correctly applicable to this scheme.

However other schemes are also possible, and offer some significant advantages. We believe that the optimum solution in the near term is to use a 2:1 length ratio of positive and negative dispersion fibers. We have carried out many experiments with fiber with appropriate characteristics to be used in the 2:1 length ratios, and we expect such optical fibers to become commercially available in 2001.

By careful selection of such fibers, and the exact length ratio of the two types, it is possible to achieve very low overall dispersion slope for very long systems (up to 10,000 km).

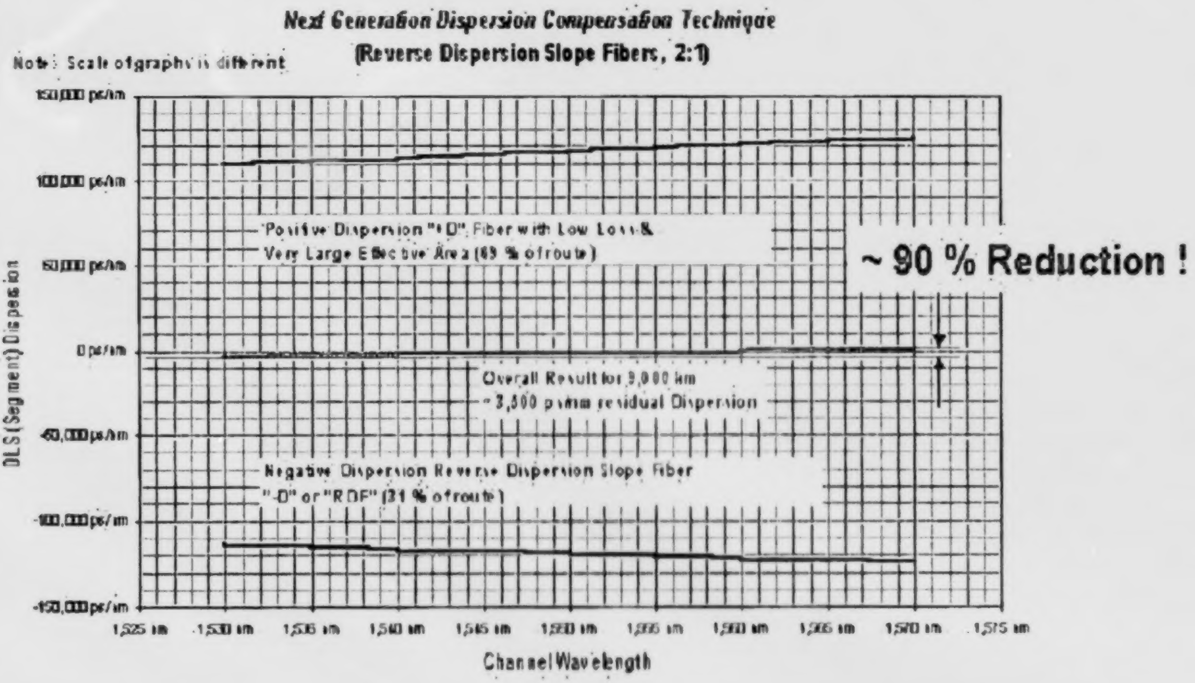

Figure 6: Dispersion vs Wavelength for Reverse Dispersion Slope Fibers

Examples of the dispersion map for a systems using conventional NZ-DSF optical fibers and using the new +D/-D optical fibers is shown in Figure 7. It can be seen that for long systems utilising almost all of the available optical bandwidth, the reduction in accumulated differential chromatic dispersion is at least 90 %.

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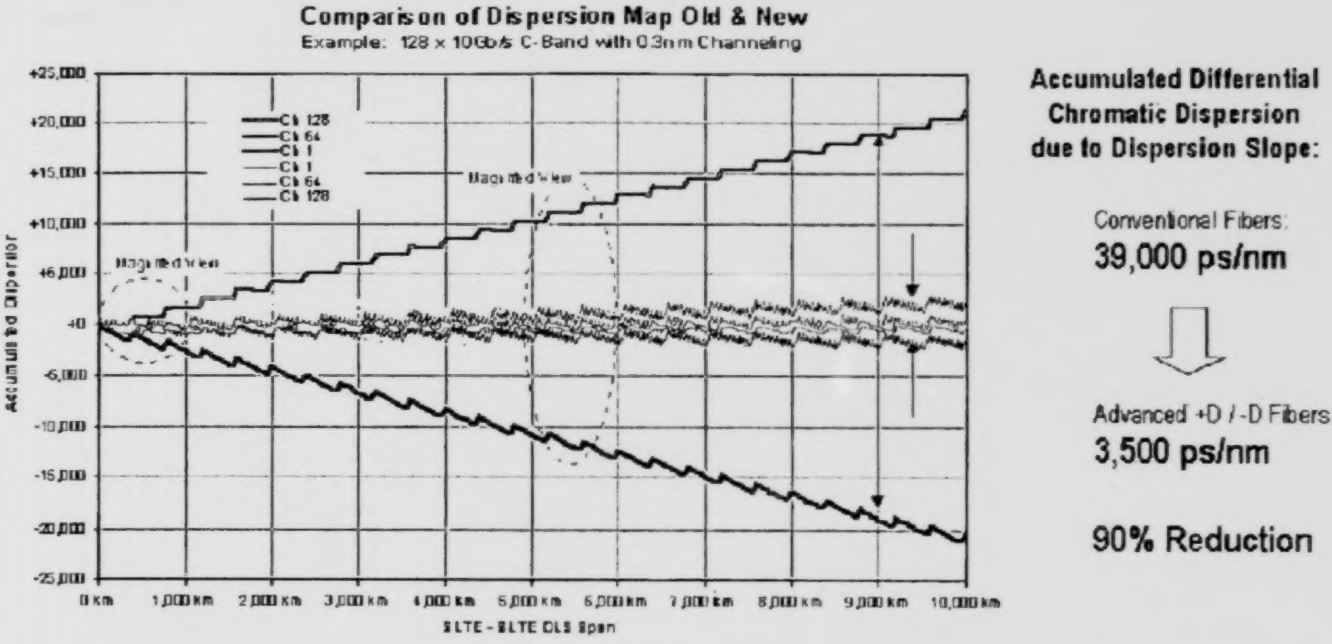

Figure 7: Dispersion Map for Conventional & +D / -D (RDF) Optical Fibers

In addition, the larger amount of the positive dispersion fiber (typically around 70 % of the total span) gives rise to a very low average attenuation.

Although the negative dispersion & negative slope fiber has a very small Aeff, it is placed at the end of the span where the channel power is lowest, and so the impact on non-linear degradations is not significant.

In fact, rather than being a disadvantage, this low value of Aeff of the negative dispersion fiber can be successfully turned to an advantage and can be successfully utilised to provide Distributed Raman Amplification (DRA), a new amplification technique explained below.

Additionally, the relatively high value of local dispersion (approx +20 ps/nm/km and approx -50 ps/nm/km respectively for the two different kinds of fiber per span) helps to reduce Four Wave Mixing (4WM) non-linear degradations.

The physical construction of cable using 2:1 +d / -D optical fibers is shown in Figure 8.

Example of 4 Fiber Pair Cable:

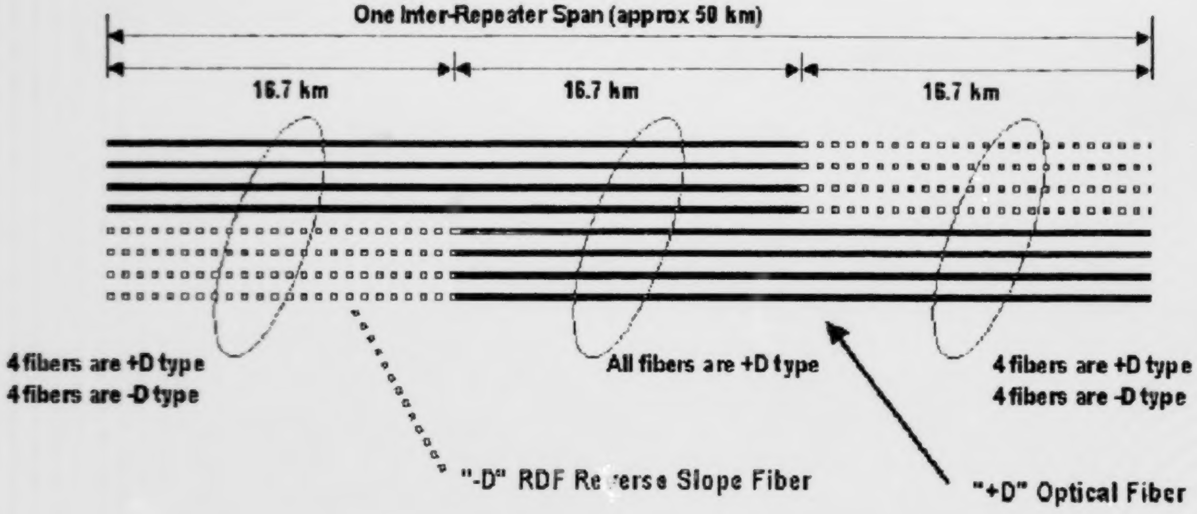
One Inter-Repeater Span (approx 50 km)
16.7 km
16.7 km
16.7 km
4 fibers are +D type
4 fibers are -D type
All fibers are +D type
4 fibers are +D type
4 fibers are -D type
"-D" RDF Reverse Slope Fiber
"+D" Optical Fiber

Figure 8: Optical Fiber Types in Cable Using 2:1 +D / -D (RDF) Fibers

Lumped Amplification vs Distributed Amplification

Erbium Doped Fiber Amplification (EDFA) widely applied in WDM system so far, is a "lumped amplification" technique. In other words, the amplification takes place "lumped" in one place, within the relatively short length (20 m ~ 200 m) of erbium doped fiber in the repeater.

It is desirable to employ "distributed amplification" where some or most of the amplification takes place within the transmission medium (optical fiber) itself. In the long term, distributed EDFA techniques may be practical, by very lightly doping the transmission fiber with erbium atoms, and pumping into the transmission fiber. However, such doped transmission fiber would be very expensive, and the technique has not been widely studied so far.

Introduction of Distributed Raman Amplification

A new amplification technique which holds great promise is Raman Amplification, which is a technique that does not rely upon doping of the amplification medium with a dopant such as erbium, but instead relies on the properties of the silica (glass) optical fiber itself.

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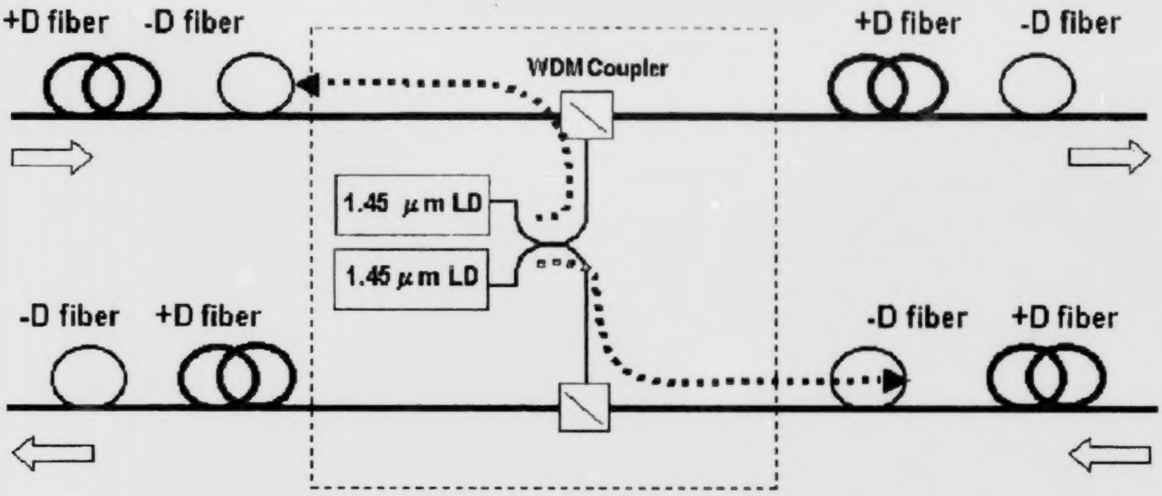

Figure 9: Repeater Configuration for Distributed Raman Amplification (DRA)

A fiber Raman amplifier utilises the Stimulated Raman Scattering (SRS) effect which occurs in silica fibers when a high-intensity pump beam propagates through the optical fiber.

In the case of EDFA, the phenomena is stimulated emission: pumping raises the erbium atoms to an excited (higher energy) state, and then an incident photon stimulates emission of an identical photon, without losing its energy.

However in case of Raman amplification, the incident pump photon gives up its energy to create a photon of reduced energy at a lower frequency (ie: a higher wavelength). The remaining energy from this inelastic scattering process is absorbed by the silica optical medium in the form of molecular vibrations (also called optical phonons).

The difference between the pump wavelength and the wavelength of the emitted photon is approximately 106 nm (13.2 THz). So the gain peak from DRA with pumping at wavelength lp is at approximately lp + 106 nm. The gain bandwidth is approximately 48 nm (6 THz). This large bandwidth makes DRA a very attractive option for submarine cable systems.

It can be seen that Raman amplification is by its nature a form of "distributed" amplification. As the pumping light travels through the fiber (in the reverse direction to the traffic signals) the intensity of the pumping is attenuated by the fiber attenuation, and so the Raman amplification becomes lower at further distances from the pump, however significant amplification can take place over several kilometres of the transmission fiber.

To achieve DRA in the C-Band (1,530 nm ~ 1,570 nm) we use Raman pump lasers with wavelength in the region of 1,430 nm ~ 1,460 nm. Pump lasers for these wavelengths are rather similar to those already deployed widely for 1,480 nm pumping of EDFA, and so the devices are relatively easy to procure.

The DRA is a back pumping technique, and since the negative dispersion fiber proposed for the 2:1 length ratio two-fiber dispersion-flattened schemes mentioned above has a rather small Aeff (~ 20 mm^2) the intensity of the pumping light in the fiber is increased, resulting in higher Raman gain.

This situation is one of the rare cases where an apparent disadvantage (in this case poor effective area) can be rather easily turned into a distinct advantage (high Raman gain). To achieve the same Raman gain with conventional fibers with Aeff of 50 mm2 ~ 80 mm2 would require much greater levels of Raman pumping (ie: more lasers, more cost, and higher power consumption).

Hybrid Amplification Schemes

In the medium term, starting from perhaps for commercial systems with Ready for Provisional Acceptance (RFPA) date in 2004, we see advantages in applying hybrid EDFA and DRA amplification.

Such hybrid amplification adds some complexity to the repeater construction, and will probably require a total of 6 pump lasers (4 for DRA and 2 for EDFA) instead of the 4 pump lasers currently used for EDFA only. However by lowering the output power level of the EDFA, and by achieving the Raman amplification within the transmission fiber (DRA), the maximum power per channel within the fiber can be reduced, with significant reductions in non-linear degradations due to XPM and SPM.

The configuration of a typical hybrid EDFA / DRA bi-directional repeater is shown in Figure 10.

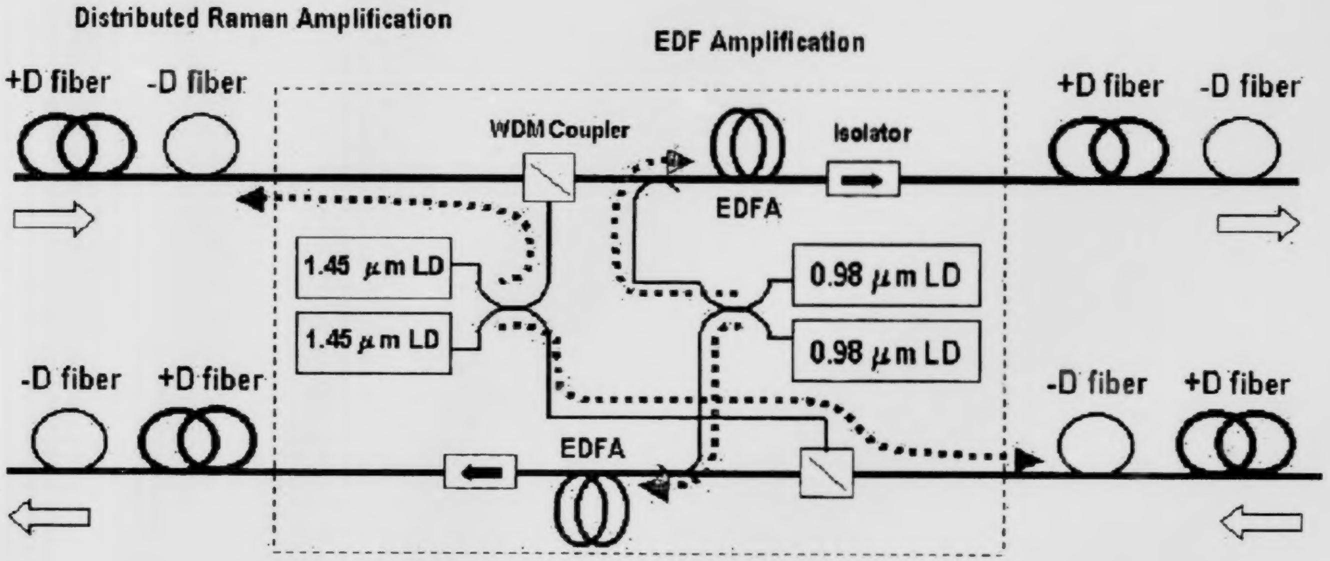
Distributed Raman Amplification
EDF Amplification
+D fiber
-D fiber
WDM Coupler
Isolator
EDFA
1.45 μm LD
1.45 μm LD
0.98 μm LD
0.98 μm LD
-D fiber
+D fiber
EDFA
+D fiber
-D fiber
-D fiber
+D fiber

Figure 10: Repeater Configuration for Hybrid EDFA & DRA

Examples of the optical power per channel vs distance along the cable span, for EDFA only and for EDFA + DRA are shown in Figure 11.

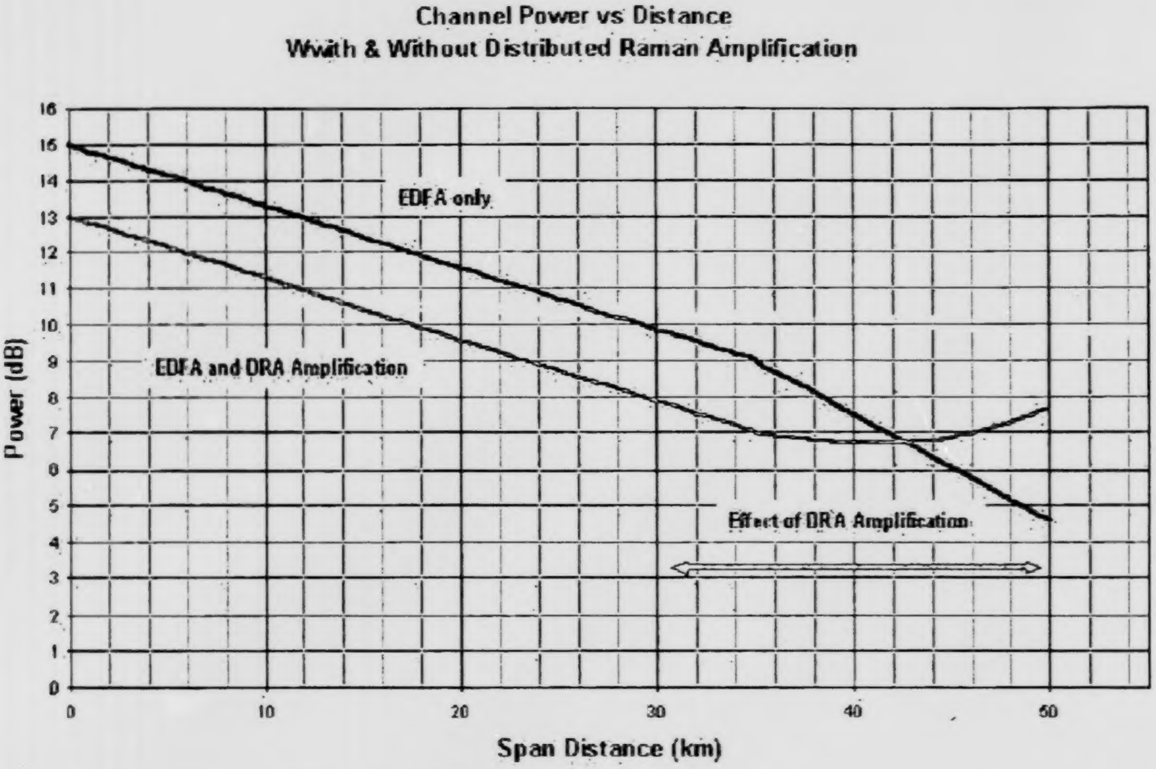

Figure 11: Channel Power in Fiber Span vs Distance

Amplitude Slope Compensation

Changes in the amplitude slope (or band-width tilt) of the overall system can occur due to aging of the optical fiber, repairs of the cable over the system life, and changes in the gain of the EDFA due to such cable aging and repairs.

In the past 2 years we have commercialised an Active Gain Slope Equaliser. This device is incorporated in a pressure vessel housing similar to that for an under-sea repeater, and is controlled by similar amplitude modulated (Amplitude Shift Keyed or ASK) supervisory commands from the terminal equipment.

In long systems (4,000 km ~ 10,000 km) and Active Equaliser is employed after every 10 or so repeaters, to bring the amplitude response back to "flat" over the frequency band of the WDM signals.

Advances in Terminal Equipment

Modulation Techniques

Before the wide deployment of dense WDM (D-WDM) system, Non-Return to Zero (NRZ) modulation was a popular scheme for 2.5 Gb/s systems. It has the advantage of lower occupied bandwidth, and relatively simpler electronics. Return to Zero (RZ) modulation is now preferred for N x 10 Gb/s D-WDM systems, since it allows higher sensitivity (higher loss per span). However it has a larger band-width occupation per channel that NRZ.

In addition to standard "pure" NRZ modulation, advanced modulation techniques, including Chirped RZ (CRZ), Single-Sideband RZ (SSB RZ), Carrier Suppressed RZ (CS-RZ), and Duo-Binary modulation are being studied for future N x 10 Gb/s systems as well as for future N x 40 Gb/s systems.

Duo-binary and CS-RZ formats seem to hold promise, and CS-RZ has been shown by experiment to reduce linear and non-linear cross-talk

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in D-WDM systems.

Forward Error Correction

Forward Error Correction has been employed in submarine systems since the late 1990's. The conventional system has been standardised by ITU-T Rec. G.975 and employs a single stage of Reed-Solomon FEC coding, with a 7 % increase in transmission data rate (eg: 9.958 Gb/s increases to 10.660 Gb/s), and an improvement of about 5.8 dB in system gain.

In 1999, several suppliers developed second generation "Super-FEC" systems employing concatenated Reed Solomon coding. The system which we are deploying commercially from early 2001 has an overhead of 20% (9.958 Gb/s increases to approx 12 Gb/s), and gives an improvement of 7.5 ~ 7.7 dB in system gain. Figure 12 shows the performance of Super-FEC.

**** With errors of**
BER = 2×10^{-3}
(1 bit error in every 500 bits)
before S-FEC,

BER after S-FEC
processing is better than
BER = 1×10^{-15}
(1 bit error in every
1,000,000,000,000,000 bits)

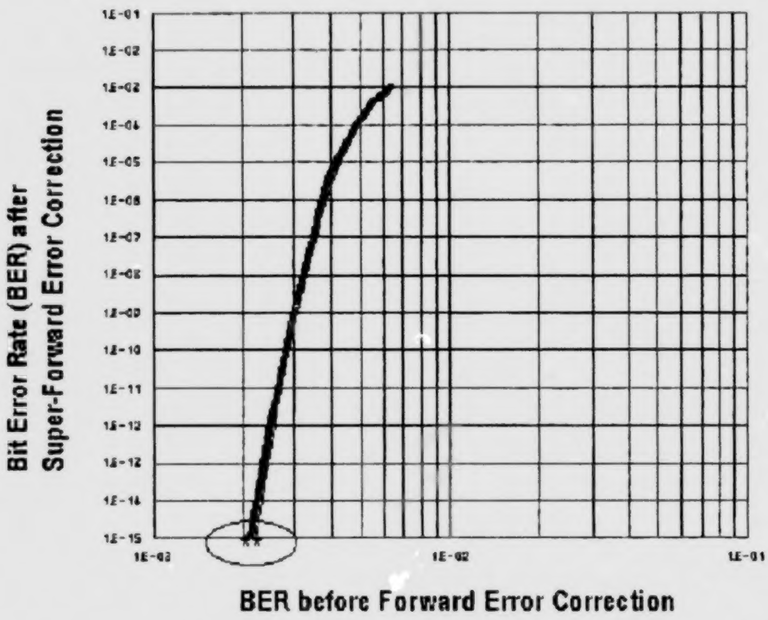

Figure 12: Performance of Second Generation Forward Error Correction (S-FEC)

In theory there is further room for "third generation" FEC schemes to be commercialised, which offer up to approximately 10 dB in system gain (ie: a further 2.0 dB approx improvement from Super-FEC).

Passive Dispersion Compensation

The adoption of +D/-D (or "RDF" or "IDF") mixed optical fiber types per span, will result in an approximate 90 % reduction in accumulated differential dispersion between lowest and highest channels of a long (>5,000 km) D-WDM system. This will significantly reduce the amount of pre-dispersion compensation (at the transmit end) or post-dispersion compensation (at the receive end) required in such long systems.

Dispersion Compensating Optical fiber (DCF), being simply fiber with high positive or negative dispersion, will continue to be used for such dispersion compensation, but in reduced quantities. The reduced quantities will lower the cost of terminal equipment, and reduce the required floor space for such terminal equipment.

Active Dispersion Compensation

In addition to passive dispersion compensation techniques using DCF optical fiber, new techniques for active compensation of chromatic dispersion as well as Polarisation Mode Dispersion (PMD) are under development in the laboratories.

One technique utilising Virtual Imaged Phased Array (VIPA) technology seems to hold good promise for compensation of fixed dispersion

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and may be applicable to compensate for residual dispersion slope as well.

However a few more years may be requiered before such systems become commercially feasible.

Tuneable Lasers

Tuneable lasers with range covering 4 channels spaced at 0.4 nm are already in commercial use in N x 10 Gb/s D-WDM submarine systems.

We are ready to commercialise tuneable lasers with much larger tuning ranges, eventually covering up to half of the C- Band or L-Band. The use of such lasers will further reduce the required spares holding for submarine line terminal equipment (SLTE).

Advances in Power Feeding

Issues in Power Feeding

Current power feeding systems supply less than 1.0 ampere, and have maximum voltage of +10,000 V or -10,000V DC. Present cables have DC resistance of 0.7 ohm/km to 1.6 ohm/km.

The advent of cables and repeaters with higher fiber counts (currently up to 16 fiber or 8 fiber pairs) increases the voltage drop across each repeater when using EDFA. Furthermore, application of hybrid EDFA and DRA will require more pump lasers and higher overall pumping power, which will also increase the power consumption (hence voltage drop) per repeater.

Solutions with New Power Feeding Equipment

In ultra-high capacity very long systems, employing such high fiber count repeaters, and/or with hybrid DRA / EDFA architecture, we will apply a higher DC line current, in the region of 1.6 ampere.

Increasing the line current to 1.6 amp can give a 23 % increase in power available to the repeaters for an 8,000 km system using 0.7 ohm cable.

If we can develop lower resistance cable (for example 0.5 ohm/km) in future, then at line current of 1.0 amp we will gain 11 % in power available to the repeaters, but we will gain 23 % at a line current of 1.6 amp.

Using 1.6 amp and 0.5 ohm together, for an 8,000 km system we can increase the repeater power by > 50 % compared to 1.0 am x 0.7 ohm/km.

Very long systems with very high capacity will need to employ dual-end power feeding, but will sometimes not be possible for the system to survive failure of the power feeding from one end. So as well as developing a new range of high-current 1.6 amp PFE equipment we have developed an ultra-high reliability PFE architecture employing N:1 and N:2 unit redundancy, allowing any power converter unit to fail at either end, and be replaced in-service without any traffic interruption.

Next Generation 40 Gb/s

Submerged Plant for Next Generation 40 Gb/s Systems

The next logical step for transmission bit rate (time division multiplex or TDM rate) from 10 Gb/s is 40 Gb/s.

Such an increase will bring 4 times the traffic capacity for the same number of WDM waves, but we must realise that the maximum number of waves of 40 Gb/s line rate will be approx 25 % of the maximum number of waves of 10 Gb/s, since the occupied band-width of the 40 Gb/s traffic streams is 4 times the occupied band-width of 10 Gb/s streams.

Hence we can only expect to be able to fit around 32 ~ 50 waves of 40 Gb/s into the C-band or into the L-Band, compared to around 128 ~ 200 waves of 10 Gb/s.

So the main benefits of 40 Gb/s systems will not be the ultimate capacity per fiber, but will hopefully be cost savings per bit and floor-space occupation reductions at the terminal stations.

Submerged Plant for Next Generation 40 Gb/s Systems

It must be accepted that 40 Gb/s systems will have 4 times the bandwidth per channel and so 4 times the noise per channel (6 dB), as well as 16 time more susceptibility to chromatic dispersion and polarisation mode dispersion, and 4 times the susceptibility to jitter.

The introduction of DRA to the submerged plant will help to enable us to maintain as large as possible repeater spacing for N x 40 Gb/s systems, but the spacing will always be considerably shorter than for N x 10 Gb/s systems with the same power per channel.

Terminal Equipment for Next Generation 40 Gb/s Systems

The timing of the commercial development of terminal equipment for N x 40 Gb/s submarine applications largely depends upon the progress in introducing N x 40 Gb/s systems into terrestrial networks.

We believe that by 2004 we will be in a position to supply N x 40 Gb/s submarine systems over spans up to 4,000 km, however longer spans will require further breakthroughs in technology, including low noise amplifiers, detectors, FEC, and active dispersion

compensation.

Floor Space Requirements

Floor space occupation at submarine terminal station is a major issue for the purchasers of very high capacity systems. We believe that floor space occupation will be one of the major drivers towards N x 40 Gb/s systems, however at the same time there will be strong efforts by suppliers to use new technologies to reduce the floor space occupation of N x 10 Gb/s systems over time.

We have made an estimate of the floor space comparison between N x 10 Gb/s systems and N x 40 Gb/s systems (based on year 2000 technologies), as follows:

10 Gb/s: (64+4) x 10 Gb/s x 1fp = 680 Gb/s = 5.9 m2
40 Gb/s (16+1) x 40 Gb/s x 1fp = 680 Gb/s = 3.2 m2
(55 % of the 10 Gb/s case, saving 45 %)

10 Gb/s: (128+8) x 10 Gb/s x 1fp = 1,360 Gb/s = 9.5 m2
40 Gb/s: (32+2) x 40 Gb/s x 1 fp = 1,360 Gb/s = 4.2 m2
(44 % of the 10 Gb/s case, saving 56 %)

It can be seen that the savings are very significant, but they are certainly not 75 % as might be initially assumed, because there is a significant contribution from the common DWM portion of the SLTE.

As the size of 10 Gb/s equipment is reduced over time, the comparison between N x 10 Gb/s terminal equipment and (N/4) x 40 Gb/s terminal equipment will need to be constantly updated.

3. Impacts on Initial Price of a Trans-Pacific Submarine Network

We have tried to make best estimates of how the above enabling technologies will have on the cost of various components of an overall submarine networks, to estimate the trends in price which will come about from new enabling technologies.

As a model we used a typical trans-Pacific ring protected network with 6 or 8 fiber pairs, and ultimate capacity of 105 waves per fiber pair, and an initially equipped capacity of approx 320 Gb/s.

If the use of the above technologies, particularly +D / -D optical fibers and EDFA + DRA amplification, can give us an increase the inter-repeater spacing by approx 20 %, then we can expect an approx 15 % saving in initial price of the system, which translates into a price-per-bit reduction of 15 % for the initial capacity.

Most of the above enabling technologies affect the submerged equipment, and so the biggest impact is upon the price for the initial capacity. When the system is fully equipped, the impact of the above technologies is much smaller, at around 5 % reduction. The resulting cost per bit will be approx 85% lower then the cost per bit of the 320 Gb/s initial capacity.

4. Some Recent Experiments to Validate New Technologies

All system suppliers continue to validate their new technologies and proposed new systems by practical experiments. The details of a major recent experiment which we have performed were published in a Post Deadline paper to the European Conference on Optical Communications (ECOC 2000) held in Munich Germany in September 2000.

The experiment utilises +D / -D transmission fibers, and hybrid EDFA and DRA, to achieve a total capacity of 211 x 10 Gb/s (2.11 Terabit/s) over a single optical fiber, over a distance of 7,221 km with a repeater spacing of 80 km.

Figure 13 to Figure 17 show the configuration and results of the experiment, and the results show how effective Distributed Raman Amplification can be in increasing the repeater spacing of ultra-high capacity long-haul systems.

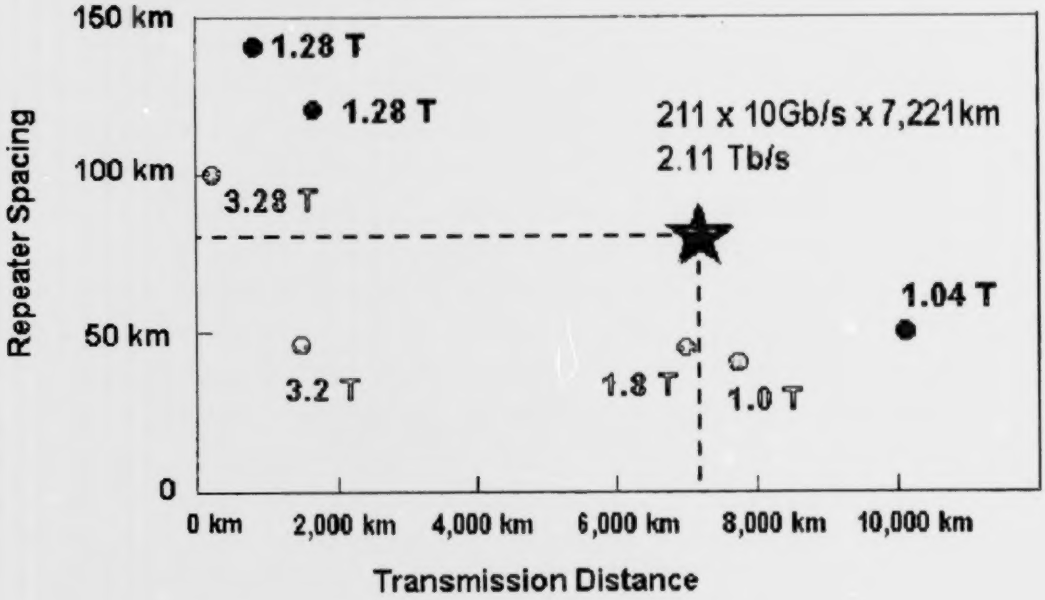

Figure 13: Comparison of Recent Experiments

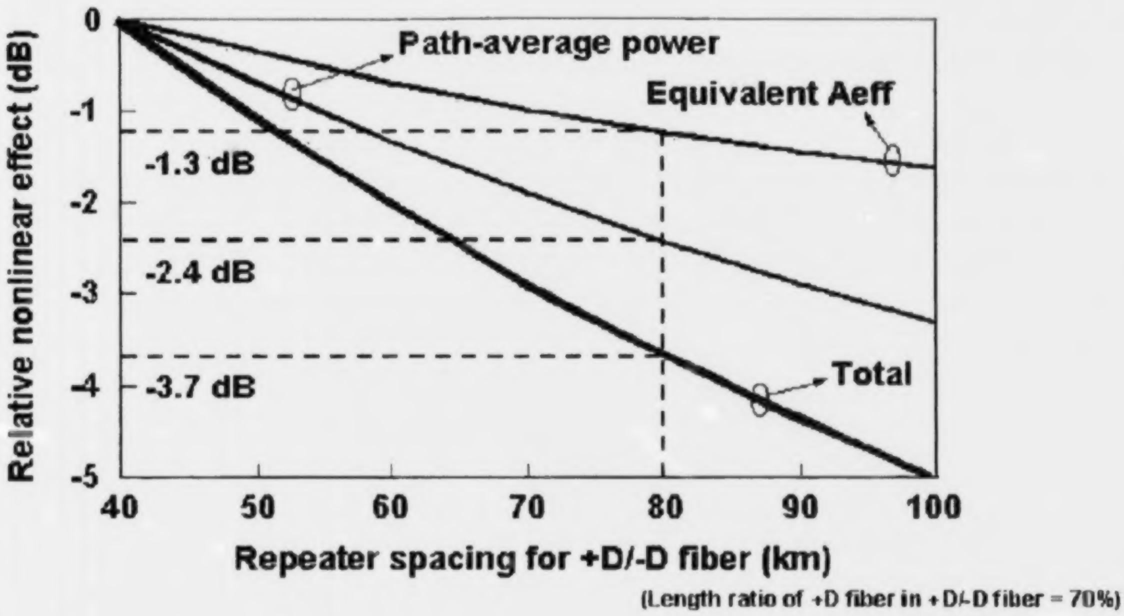

Figure 14: Improvement in Non-Linear Degradation vs Repeater Spacing

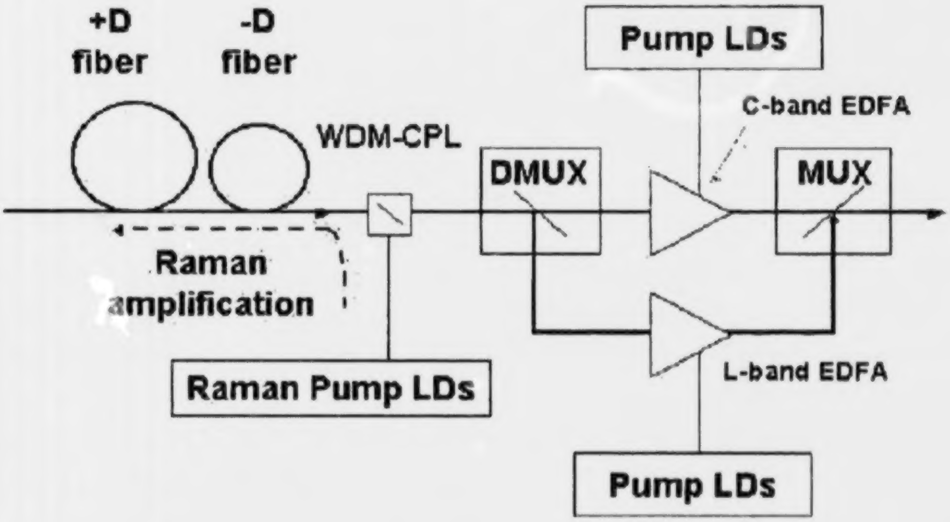
+D
fiber
-D
fiber
WDM-CPL
Raman
amplification
Raman Pump LDs
DMUX
Pump LDs
C-band EDFA
MUX
L-band EDFA
Pump LDs

Figure 15: Hybrid Repeater Configuration

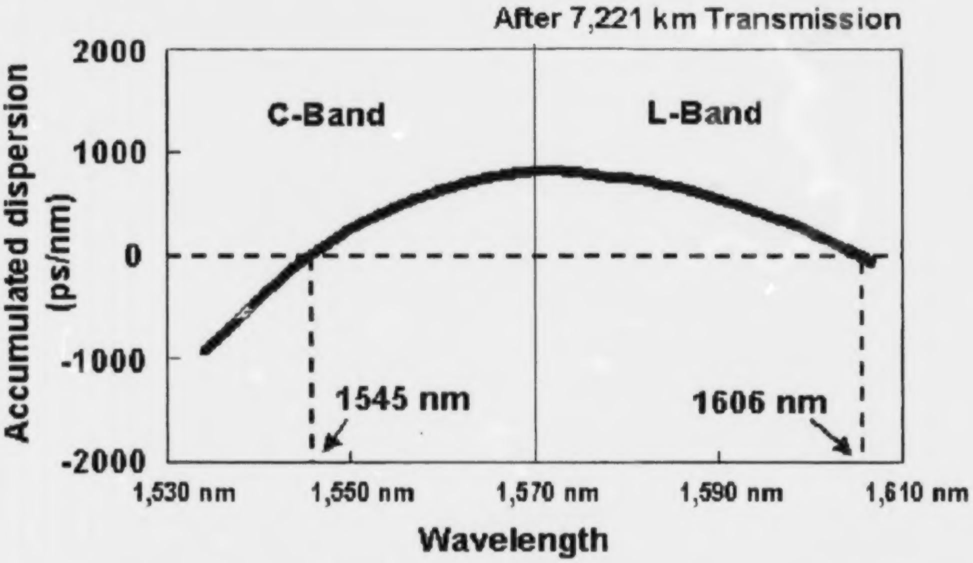

Figure 16: Overall Dispersion vs Wavelength for +D / -D Combination

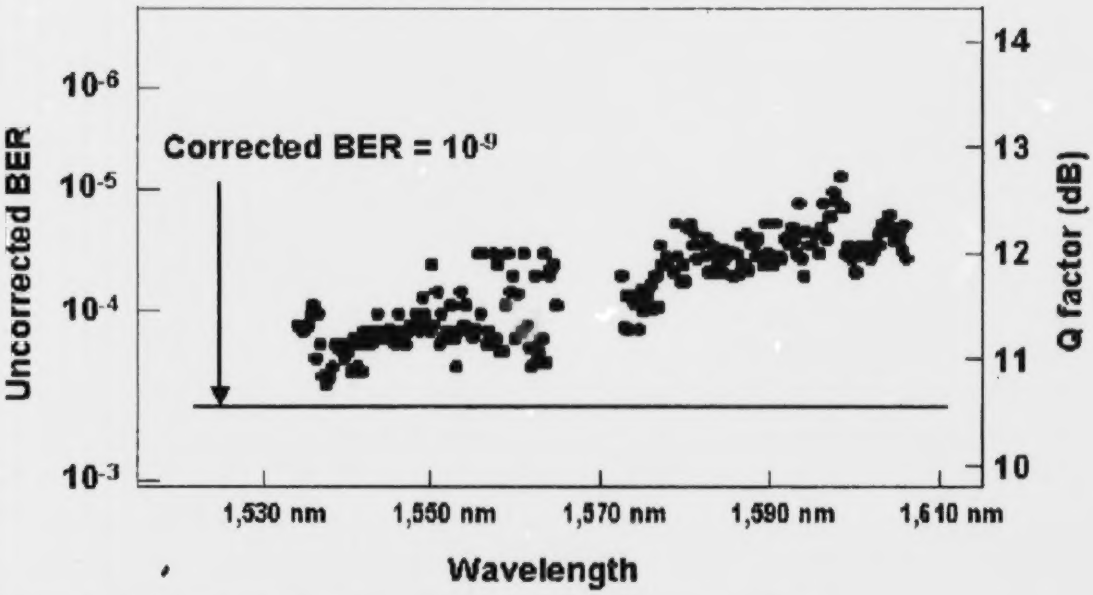

Figure 17: Mesured Results after 7,221 km Transmission

6. Conclusion

As explained at the beginning of this paper, suppliers of submarine cable systems face dual requirements from potential customers for higher ultimate system capacity and lower cost per bit, when partially equipped (at beginning of life) and at full-capacity (when fully equipped).

In this paper we have given a brief summary of what we believe they key enabling technologies are, to achieve such increases in capacity and reductions in cost.

We anticipate further exciting technology progress over the year 2001, and look forward to reporting the updated situation next year at PTC2002.

Back to top of page **Back to the sessions page**

Katsutoshi Tamura

Katsutoshi Tamura was General Manager of the Submarine Networks Business Division in Fujitsu Limited's International Telecommunications Business Group, until late 2000, where he was responsible for all sales and marketing and all commercial aspects of Fujitsu's submarine networks business activities in overseas markets. Since December 2000, Mr Tamura has been General Manager of Business Development in Fujitsu International Engineering.

Mr Tamura was born in the city of Zushi, near Kamakura, some 50 km south of Tokyo, where he and his family still live. He graduated from Tokyo's Rikkio University (also known as St Paul's University) in 1968, with a degree in economics.

He joined Fujitsu Limited in 1968, and was initially engaged in the sales and marketing of terrestrial telecommunications systems in Asia, and satellite communications equipment to world-wide markets.

He has spent the past 20 years in the submarine telecommunications business group, where his group's recent achievements have included successful bids for the China-US Cable Network, the SEA-ME-WE 3 Cable Network, the Japan-US Cable Network, the North Asia Cable Network, the Nava-1 Cable, and the Southern Cross Cable Network.

Back to proceeding page   Back to the sessions page

Tatsuo Matsumoto

Tatsuo Matsumoto is currently Senior Director of Fujitsu Limited's Submarine Telecommunications Engineering Division, and is responsible for all system engineering and project management of overseas submarine cable networks.

He was born in Yuki city, in Ibaraki Prefecture north of Tokyo, and graduated from the Fujitsu Technical Institute in 1967, after which he joined the Transmission Engineering Group of Fujitsu Limited, based in Kawasaki, Japan.

His work experience over the past 20 years includes significant involvement in research into reliability of transmission systems, development of terrestrial transmission systems, development of power-line protection equipment, and the system engineering, planning and development of terminal equipment for submarine cable systems.

He has recently had in-depth involvement in the project management of several projects including the SEA-ME-WE 3 Cable Network, the Southern Cross Cable Network, and the Japan-US Cable Network, as well as in the planning and bidding for future networks.
Mr Matsumoto is a member of The Institute of Electronics, Information and Communication Engineers (IEICE) Communications Society.

Back to proceeding page **Back to the sessions page**

Colin Anderson

Colin Anderson holds the position of Business Development Manager in the Submarine Networks Sales & Marketing Department of Fujitsu Limited's International Telecommunications Business Group.

He was born in Wanganui, New Zealand, a small city approximately 200 km north-west of the capital city of Wellington, and received a BSc degree, majoring in physics, from Victoria University in Wellington New Zealand in 1975.

From 1976 he worked for Philips New Zealand Ltd in engineering and marketing roles, until he joined Fujitsu New Zealand Ltd in 1986, as a senior marketing engineer for telecommunications systems.

In 1984 he started part-time post-graduate business study, and in 1988 received an MBA degree from the Victoria University Graduate School of Business and Government.

In 1992 he moved to Tokyo Japan, to take up a position in the International Telecommunications Business Group of Fujitsu Limited, initially as an assignee on a 2-year contract, primarily supporting optical and wireless SDH transmission business in the South Pacific region. Now, 8 years later, he is a full-time staff member of the parent company, Fujitsu Limited, and is currently Business Development Manager for the Submarine Networks Sales & Marketing Department.

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Back to proceeding page   **Back to the sessions page**

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Howard D. Kidorf is the Director of the Services Engineering Division at TyCom in Eatontown, New Jersey. After joining AT&T Bell Laboratories in 1984 he has spent his career in the field of undersea optical communications. His first responsibilities were for various aspects of the design and manufacture of 280 Mb/s and 560 Mb/s regenerative undersea repeaters. Since then, he has been responsible for the design of Tycom's optically-amplified repeater and the development of large-scale test facilities to investigate high capacity WDM technologies. In his most recent research activities, Mr. Kidorf has been investigating wide band optical amplifier technology, Raman amplifiers, and advanced error correction codes. He has a B.S.E.E degree from Rutgers University and an M.S.E.E degree from Rensselaer Polytechnic Institute in Troy, N.Y.

Back to proceeding page **Back to the sessions page**

Program

☑ **Policy / Regulatory**

Tuesday, 16 January 2001
1100–1230

T.2.5 Internet and IT Governance

Chair: TBC

T.2.5.1 ICANN: Shifting the Fulcrum of Regulatory Power (ABSTRACT)

LIZ WILLIAMS, Doctoral Scholar, Faculty of Information Technology, Queensland University of Technology, *Australia*

T.2.5.2 A Strategic Policy Idea That Achieves Balance Between Online Users' Privacy Concern and Lawful Access (ABSTRACT)

JOHN OLUROTIMI AYOADE, Doctorate Student and TOSHIO KOSUGE, Professor, University of Electro-Communications, *Japan*

T.2.5.3 GRECOS–Global Responsibility, Encrypted Coordinate, Operating System (ABSTRACT)

GEORGE RICHARD BAIER, M.S. Telecommunications Program (matriculating) & SAE, PaeTec Communications, Inc., *USA*

ICANN - Shifting the Fulcrum of Regulatory Power [1]

Liz Williams

Abstract

www.lizwilliams.net

". .writing about the Internet. . .even if it is neither merely descriptive nor technical, faces the risk of being out of date even before it reaches the bookshops" (Graham 2000: 1)

Introduction

This paper is part of broader doctoral dissertation research into the globalisation of regulation and the domain name industry. The work focuses on the role of the Internet Corporation for Assigned Names and Numbers (ICANN) in the implementation of private sector regulation of a business with global implications.

The work focuses on ICANN's role on developing and implementing policy that has an impact across both the public and private sector with, in almost all policy examples, the private sector taking the lead and the government sector "submitting views". This is most obviously borne out in the relationship of the Government Advisory Committee (GAC) in is role as a "supporting organisation".

ICANN's role in the establishment and maintenance of a global regulatory framework which is responsive to the shifting dynamics of a digital environment are important to understand, not only as it relates to the domain name industry but, more broadly, as a model for future regulatory structures.

The research here tracks the development ICANN's mandate, from the US Department of Commerce, to manage the technical aspects of the Internet - and by default, the policies and processes that surround that management. The most important feature of this work is tracking the shift from government focused regulation, firmly within the purview of civil servants, to a privatized system, run on a minimal cost-recovery budget, managing consensus-driven input and influence from the private sector as well as balancing the input of governments through the Government Advisory Committee (http://www.icann.org/gac/gac.htm).

The paper reaches some early conclusions about "influence drift" to global regulators from national legislatures and the role both governments and corporations play in international forums such as ICANN. Other sections of the dissertation research traces the changing nature of corporate involvement in regulatory decision making as governments withdraw from direct regulatory responsibilities towards co-regulation and self-regulation models in electronic commerce, as evidenced by the establishment of ICANN's various "constituencies".[2]

Research Scope

The research for this paper is focused on three main assumptions. Firstly, to demonstrate that the regulation of "public resources" (the Domain Name System or DNS) has moved away from national governments. This movement is both deliberate on the part of governments, in this case the US Department of Commerce, and inevitable as the nature of regulation, in a globalised and electronic trading environment develops. Governments still have an active role to play, as evidenced in the case of ICANN by the strenuous participation of governments in the GAC and the contentious nature of their regulator communiqués. For the final paper, further work on the interface between the GAC and ICANN's constituencies and the ICANN Board.

The second assumption is that the private sector is being forced to meet the costs of this new kind of regulation - in part because governments are unwilling to fund activities over which they only have indirect control. Perhaps more accurately though, the cost of regulation is met by the private sector because it is they who derive most benefit and should, therefore, bear the cost burden. ICANN's budget[3] is a source of considerable angst, mostly due to the fact that it is difficult to extract financial support from participants - both countries and corporations - but the regulatory challenges that this arena presents are ongoing. ICANN's funding challenges have deepened with threats of the ccTLD constituency defecting in protest at, even though they contribute financially to ICANN's coffers, they have no Board representation. The United States General Accounting Office, in its 7 July 2000 Report, identifies quite clearly the difficulties with ICANN's funding and the sensitivities caused by a lack of secure funding. There is, as yet, no clear way forward as evidenced by both the Registrar's and ISP Constituency meetings at the November 2000 ICANN meetings in Los Angeles.

The third assumption is, as Mueller (2000) has identified, the result of the shifting plates of regulation where "institutional innovation" illustrates a change in the regulatory and geo-political landscape. This is illustrated most particularly where the formation of ICANN has necessitated a shift in the attention range of large corporations. The establishment of new gTLDs is case in point. ICANN, a private sector not-for-profit organisation, has responsibility for determining the environment in which a wide range of intensely "for profit" corporations make their money. Understandably, the ICANN Board and Staff come under intense pressure from those corporations to perform to their expectations whilst, at the same time, ICANN balances scrutiny from government officials, free speech and civil society activists[4] and the technical community, all of whom are active, vocal and, at times, hypercritical of ICANN outcomes.

A Microcosm of Internet Management: The Importance of ICANN's Structure

The organizational structure[5] of ICANN reflects its "bottom-up" governance model, driven by consensus on decisions from its member constituencies. The natural tensions which occur in decision making with ICANN where there are vastly divergent commercial and social policy interests.

ICANN's constituencies are an important guide to the influence patterns of the organisation and the decisions that are made. Of most current importance is the expansion of the global top level domain (or gTLD) name space.[6] The conflicting arguments from all sides will be examined in the final paper to make some assessment of ICANN's ability to resolve disputes and to manage, by consensus, reasonable regulatory and commercial outcomes. As Cerf and Kahn have identified, ". . .other political and social dimensions that enabled the Internet to come into existence and flourish are just as important as the technology upon which it is based. . .". (Cerf & Kahn 1999:<4)

The History: In focus

This section outlines some historical background to ICANN's inception. More general Internet histories are easily found (Hafner, Berners-Lee & Reid) which comprehensively trace the gestation, birth and early years of the Internet. In the context of this paper though ". . .the management of the Domain Name System offers a kind of microcosm of issues now frequently associated with the overall management of the Internet's operation and evolution. . . .It is helpful to consider separately [and then ICANN's role] the problem of managing the domain name space and the Internet address space. . . Domain names have semantics that numbers may not imply;

and thus a means of determining who can use what names is needed. . .." (Cerf & Kahn 1999: 6)

The history of the Internet, for the purposes of this paper, is limited to that which relates to the work of ICANN. The development of the DNS, which is a crucial part of how the Internet actually works, focus discussions about ICANN for two reasons: the Internet architecture is vital for discussions about electronic commerce (just one more application for the Internet protocol to support) and that architecture (and its very creative use) provides research material that is directly concerned with commercial gain in electronic trading - that is, the trade and management of domain names. Focus on precisely what ICANN's mandate is then, particularly important.

"ICANN has been designated by the US Government to serve as the global consensus entity to which the US Government is transferring the responsibility for co-ordinating the management of the domain name system, the allocation of IP address space, the assignment of protocol parameters, and the management of the root server system." According to an undated ICANN fact sheet, "ICANN's mandate is *not* to 'run the Internet'. Rather, it is to facilitate the coordination and management of only those specific technical managerial and policy development tasks that require central coordination". Separating out this comprehensively technical regulatory decision making is difficult when the Internet presents many other opportunities for regulatory intervention - from everything to content control to bit taxes.

ICANN becomes then a case study of new economy regulation, a hybrid of international regulation and corporate influence that has no precedent especially with respect to its private sector nature, tasked with specific regulatory responsibilities that historically would have resided with a government bureaucracy or an independent arm of government, funded by taxpayers. It is useful to track the parallels and differences between the ITU - the old guard multi-lateral regulator and ICANN - the new breed of regulator which relies for its success (or failure) on drawing out consensus from substantially divergent positions. The crux of the success relies on a system whereby there is no sanction or penalty for non-compliance as ICANN has no enforcement powers.

Into the future

The growth of ICANN, its charter of operation and key stakeholders are important in understanding the development of dispute resolution mechanisms. In ICANN's case the disputes are principally about ownership of domain names and protection of intellectual property in addition to managing the technical stability of a global resource[7]. The new complication, as Mueller (2000) has argued, is that the technical management of numbers corresponds also to the management of highly valuable and easily identifiable names. As such, the regulatory and commercial stakes are high, even if one were only to use NASDAQ company valuations. Even though ICANN has had many detractors, it is a crucially important regulatory body - the Federal Networking Council provide a neat description about what the Internet is and we are able to deduce from ICANN's mandate, what ICANN's role is with respect to the rest of the Internet.[8]

Key issues for further examination

Mueller's (2000) view focuses on the creation of new "property rights" and the regulatory arbitrage associated with the formation of new value in domain names. Cerf & Kahn (1999) explain neatly and simply what used to be the case- "In order to work properly, the architecture required a global addressing mechanism (or Internet address) to enable computers on any network to reference and communicate with computers on any other network in the federation. Internet addresses fill essentially the same role as telephone numbers do in telephone networks." (Cerf & Kahn 1999: 3)

Mueller's work explains "a narrative about how the commercialization of Internet domain names led to the formation of a new international regime for regulation and dispute resolution" (Mueller 2000: 1) The next stage of analysis is to understand what role ICANN plays in resolving disputes about names and numbers, even before we get to any analysis about the utility of ICANN's Uniform Dispute Resolution Policy or UDRP[9].

Summary

In summary, the presentation paper will focus on:

- Globalisation of regulation and ICANN as a case study
- The impact of ICANN on the development of multi-jurisdictional, non-governmental policy making and dispute resolution mechanisms
- It will track the government/corporate influence flows on a private sector corporation tasked with technical management and policy decisions that govern the direction of the Internet

"Institutions channel human behavior into certain paths by affecting relative transaction costs; i.e., by making some kinds of interactions highly costly and uncertain while making others convenient and secure". (Mueller 2000: 2) We examine the changing nature of regulatory participation and what that means for dispute resolution in electronic commerce. We note that ". . .Organizations are created to take advantage of those opportunities, and, as organizations evolve, they alter the institutions" (p2) and conclude that this is a process which is evolving and which requires close scrutiny.

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End Notes

[1] This paper is part of broader research for a doctoral dissertation with the Queensland University of Technology's Faculty of Information Technology. For further papers and publications, see www.lizwilliams.net.

[2] See ICANN's organisation chart at http://www.icann.org/general/icann-org-chart_frame.htm.

[3] http://www.icann.org/financials/budget-fy00-01-06jun00.htm

[4] See, for example, Michael Froomkin's homepage http://www.law.tm/

[5] http://www.icann.org/general/icann-org-chart_frame.htm

[6] The November 2000 results can be found at http://www.icann.org/announcements/icann-pr16nov00.htm

[7] "As a non-profit, private-sector corporation, ICANN is dedicated to preserving the operational stability of the Internet; to promoting competition; to achieving broad representation of global Internet communities; and to developing policy through private-sector, bottom-up, consensus-based means. ICANN welcomes the participation of any interested Internet user, business, or organization." Specifically, ICANN coordinates the assignment of the following identifiers that must be globally unique for the Internet to function:

- Internet domain names
- IP address numbers
- protocol parameter and port numbers

In addition, ICANN coordinates the stable operation of the Internet's root server system. www.icann.org

[8] "The Federal Networking Council (FNC) agrees that the following language reflects our definition of the term "Internet".

"Internet" refers to the global information system that --
(i) is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons;
(ii) is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other

IP-compatible protocols; and
(iii) provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein." 24 October 1995 (http://www.fnc.gov/Internet_res.html)

[9] More information can be found at http://www.icann.org/udrp/udrp.htm.

Back to top of page **Back to the sessions page**

Liz Williams

Liz Williams is a Doctoral Scholar with QUT's Faculty of Information Technology (www.qut.edu.au) completing a dissertation on the globalisation of regulation and the domain name industry. Her work focuses on the relevance of governments in global markets and the role of the private sector in regulation.

Liz has a strong background in telecommunications regulation and is involved in the Australian Internet Industry as Chair of the Internet Industry Association's Electronic Commerce Taskforce. She is a member of.auDA's Competition Model Advisory Panel who is researching competition models to open the domain name space in Australia. She is a member of the Internet Society, the Internet Industry Association and auDA. More detailed professional information, including publications and conferences, can be found on her website at www.lizwilliams.net.

Liz divides her relaxation time between her two young daughters, her Canberra garden and her Weimaraner.

Back to proceeding page **Back to the sessions page**

Balancing Lawful Access and Privacy Concerns

John Olurotimi Ayoade and Toshio Kosuge

Abstract

www.uec.ac.jp

1.0 Introduction

The privacy problem has always been in existence for long but much concentration and recognition was not actually given to it until of recent times. However, there must be a reason for people to have full focus on this issue of privacy on the Internet. Many and more of the privacy issues and the adverse effects that violation of individual privacy has had, is having and will have are discussed in this research work.

Individuals or entities who own, control, access, use or store data may have a responsibility to protect the confidentiality and integrity of such data, and may therefore be responsible for using appropriate security methods. It is expected that a variety of security methods may be needed to fulfill different data security requirements. Users should be free, subject to applicable law, to determine the type and level of data security needed, and to select and implement appropriate methods, including a key management system that suits their needs. A careful study of the security issues in communication systems is warranted and inevitable.

1.1 What is Lawful Access[1]?

Around the world only few countries allow the use of encryption for the protection of privacy of individual in the World Wide Web but of recent times, things are changing, many countries are compromising and shifting their stand as touching the restriction to the domestic use of encryption by their citizens, for example U.S.A. A critical issue presented by cryptography -- perhaps the most widely debated aspect of cryptography and the one most likely to lead to disparate national policies -- is the perceived conflict between Privacy/confidentiality and public safety. While the use of cryptography is important for the protection of privacy, there may be a need to consider appropriate mechanisms for lawful access to encrypted information. For example, in many countries, law enforcement can lawfully access stored data or intercept communications (or both) under certain conditions. Both of these important law enforcement tools could be curtailed by the use of cryptography, which can prevent lawful access to either plaintext, or cryptographic keys of encrypted data. In some cases, encryption of stored data can make law enforcement access impossible, while in other cases, the data can be lawfully accessed elsewhere (such as obtaining financial records from a bank rather than a person's home computer), or the key could be obtained to decrypt the data.

1.2 What is Privacy?

According to Privacy[2] and Human Rights' view, privacy is the most difficult to define and circumscribe. They believe that definitions of privacy vary widely according to context and environment. In many countries, the concept has been fused with data protection, which interprets privacy in terms of management of personal information. Outside this rather strict context, privacy protection is frequently seen as a way of drawing the line at how far society can intrude into person's affairs.

2.0 Basic Network security Objectives

The security services of a network have four fundamental objectives designed to protect the data and the network's resources. These objectives are:

- **Confidentiality:** Ensures that an unauthorized individual does not gain access to data contained on a resource of the network.
- **Availability:** Ensures that authorized users are not unduly denied access or use of any network access for which they are normally allowed.
- **Integrity:** Ensures that unauthorized individuals do not alter data. Related to this is authenticity, which is concerned with unauthorized creation of data.
- **Usage:** Ensures that only authorized users reserve the resources of the network for use in an appropriate manner.

2.1 Basic Network security Threats

- Opposing these objectives and the network security services are a number of threats. These threats can be described in terms of how they affect the normal flow of information in the network. There are four basic patterns of attack for these threats. These are shown in figure 1.
- The first of these is *denial of service* in which the flow of information is blocked entirely. This can be accomplished in a number of ways including affecting the medium through which that data must travel or the source host itself where the data (or request network service) resides.
- The second pattern of attack is *modification* where the contents of messages or the data itself is modified before it is received at the destination host.
- The third pattern of attack is *interception*. In this attack the normal flow of information is not affected, instead an additional flow, generally to an unauthorized source, is being created. Two examples of this form of attack are **eavesdropping**, where another (unauthorized) user gains access to the information as it is transmitted, and **traffic analysis** where information about the network, its services, and its users is obtained by observing the type, destination, and volume of traffic without knowing the contents of the messages or data sent.
- The fourth attack pattern is *creation* in which new data traffic is created and inserted onto the network, generally masquerading as data from another, authorized source.

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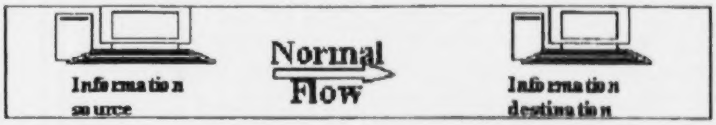

Figure 1[3] (a)

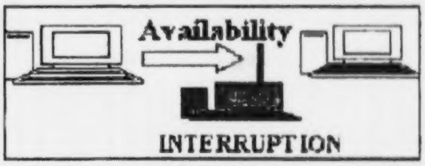

Figure 1 (b)

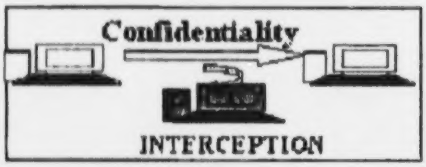

Figure 1(d)

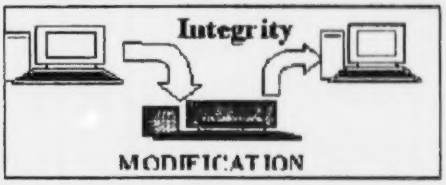

Figure 1(c)

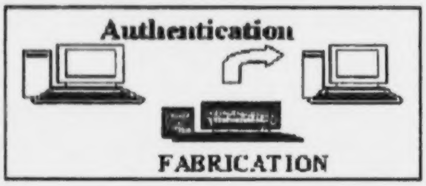

Figure 1(e)

Figure 1 shows Security Threats

3.0 Problem description

- Conflict between Privacy and Lawful Access/Public Safety

From figure 2 below, Party A sends a secret information to Party B which is protected by using an encryption technique for confidentiality or privacy purpose. However, the encryption key has to be given to or controlled by Trusted Third Party in order for the law enforcement authority/government[4] to have access to the encrypted message; which shows that there is no total privacy for users.

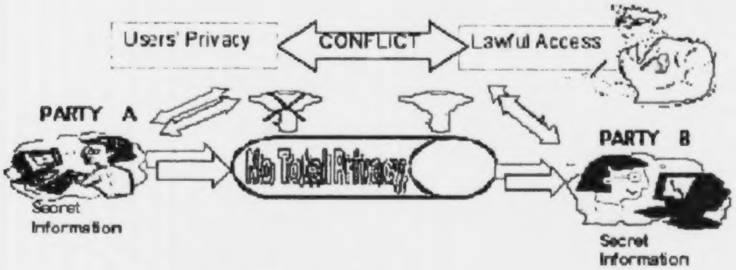

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Figure 2 shows the Problem Description

Cryptography[5] is an important component of secure information and communications systems and a variety of applications have been developed that incorporate cryptographic methods to provide data security. Cryptography is an effective tool for ensuring both the confidentiality and the integrity of data, and each of these uses offers certain benefits. However, the widespread use of cryptography raises a number of important issues. Governments have wide-ranging responsibilities, several of which are specifically implicated in the use of cryptography, including protecting the privacy rights of their citizens; facilitating information and communications systems security; encouraging economic well-being, in part, promoting electronic commerce; maintaining public safety; raising revenues to finance their activities; and enabling the enforcement of laws and the protection of national security. Although there are legitimate governmental, commercial and individual needs and uses for cryptography, it may also be used by individuals or entities for illegal activities, which can affect public safety, national security, the enforcement of laws, business interests, consumer interests or privacy. Governments, together with industry and the general public, are challenged to develop balanced policies to address these issues.

3.1 Online Transaction and Peoples Concern

One major means of making Internet communications more secure is by using encryption technique. The usage of encryption security techniques to protect information or data has numerous advantages, on the other hand, the safety of the public seems to be at great risk and gives law enforcement officials great concerns about the terrorist and criminals. However, in some countries there are various policies hampering the usage of unlimited encryption key length. While these issues have been creating a lot of problems on the mind of many people, most especially in this era of electronic commerce. According to the report by the Internet Speech and Privacy - Public Agenda Online's survey[6] carried out in June 2000 on concerns of many people about their personal information privacy on the Internet and also that there are widespread violations of laws relating to surveillance of communications, even in the most democratic countries. The survey is clearly shown in the table and graph below respectively.

	Very	Somewhat	Not Very	Not at all	Don't know
Medical records	47%	25%	14%	11%	3%
Financial records	64%	19%	8%	6%	3%
Social Security	75%	15%	4%	4%	2%
Credit card No.	74%	11%	4%	8%	3%
Phone number	51%	19%	14%	14%	2%
Home address	54%	18%	13%	14%	1%

Sample: 900 Registered Voters

Methodology: Telephone Interview Conducted June 2000

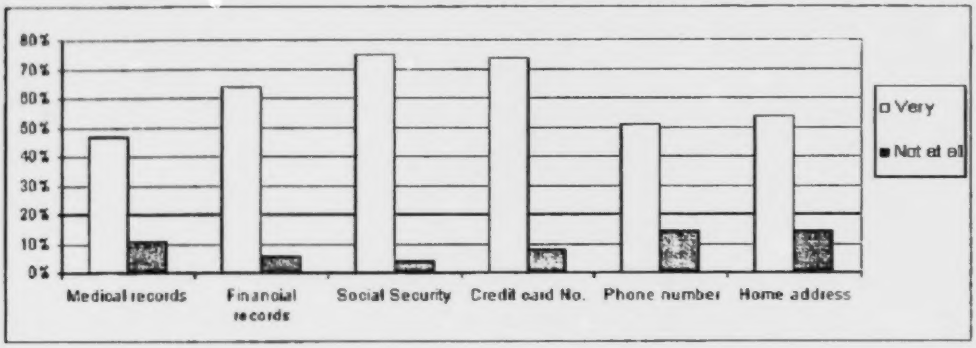

Figure 3

3.2 Japan Legal provision relating to Privacy and Security in promoting E-commerce

According to the reports carried by MPT Japan -Ministry of Posts and Telecommunications, there should be freedom for users in choosing authentication services. In conventional commercial transactions and other social and economic activities, the decision on what authentication methods to use and how much legal backing they need has been freely made between the parties to the transaction with an overall consideration of factors including the importance and necessary costs for the authentication over the Internet. Also, ensuring the protection of data of individuals, companies, and other parties. Certification organs should give consideration to the protection of data of individuals, companies, and other users-and in addition, to the protection of information on the existence of communications between the recipient and the certification organ-gained in the course of queries on the validity of electronic certificates.

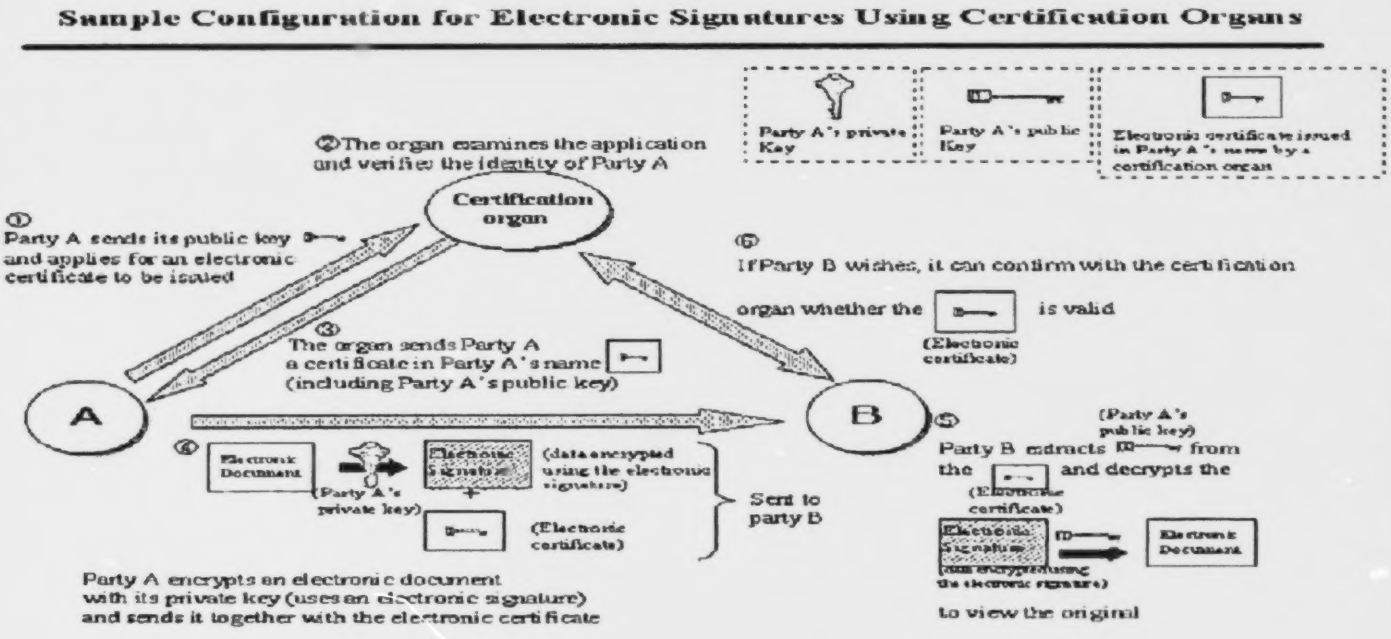
Sample Configuration for Electronic Signatures Using Certification Organs
Party A's private Key
Party A's public Key
Electronic certificate issued in Party A's name by a certification organ
② The organ examines the application and verifies the identity of Party A
Certification organ
① Party A sends its public key and applies for an electronic certificate to be issued
③ The organ sends Party A a certificate in Party A's name (including Party A's public key)
⑥ If Party B wishes, it can confirm with the certification organ whether the is valid
(Electronic certificate)
A
B
④
Electronic Document
(Party A's private key)
Electronic Signature
(data encrypted using the electronic signature)
+
(Electronic certificate)
Sent to party B
Party A encrypts an electronic document with its private key (uses an electronic signature) and sends it together with the electronic certificate
⑤ Party B extracts (Party A's public key) from the (Electronic certificate) and decrypts the
Electronic Signature
(data encrypted using the electronic signature)
Electronic Document
to view the original

Figure 4 above shows sample configuration for E-signatures using certification Organs

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4.0 Research Methodology

A basis for a possible solution to balance the interests of users and law enforcement authorities. In this research work, we proposed a SPLC[7] - Solution to Privacy and Lawful access Conflict. This process will allow users' freedom to their privacy, by using security techniques that meet their need; However, users will need to notify the SPLC about the transmission of their secret information but the users private key will not be released to the SPLC in order for the users to have their total privacy. On the other hand, public safety will be secured since SPLC is aware of the information being sent. Peradventure, if there is any illegal information sent, the sender of the illegal information or the criminal will be apprehended eventually.

4.1 Objective of SPLC

SPLC is proposed mainly to solve the problem between individual privacy[8] and Lawful access. Basically, the general model for network security allows the usage of a limited number of key length of encryption key for protecting a secret information. A typical example is a transmission of a secret information between two people, that is, Party A and Party B, however in order to conceal the information from intruder, encryption techniques have to be used. Moreover, the encrypted information's secret key will be handed over to a TTP-Trusted Third Party (in order to protect the safety of the public from some unscrupulous criminals) that can be misusing the encryption technique to conceal criminal information, which on the other hand generates another problem of fears and privacy concerns. However, in order for people to be fully involved in electronic-commerce transactions, the issue of individual privacy must be put into high consideration. This brings about the proposition of SPLC, which could guarantee the realization of total privacy for online-users on the internet and protect the safety of the public.

4.2 Function/Guidelines of SPLC

The primary role of SPLC is to register all on-line users that are interested in sending encrypted/secret data and information. A number of things will be required for registration before secret information could be sent for example, the time and date of sending the information. However, in order to identify and apprehend the suspect sending illegal information, names and addresses of the senders and receivers have to be registered. Moreover, past history of the sender and receiver will be required (in order to find out if the sender was involved in any criminal activities before), the purpose of sending the information, for example, business, personal, financial transactions and so on. However, secret key will not be required. Also, the content of the secret information will not be known since the secret key is held by senders and receivers of such information.

4.3 Registration Requirements:

- The sender's Identity Card or Driver's license or Passport or document which can prove his/her identity.
- Time of sending the secret information.
- Date of sending the information.
- Past history of the sender and receiver.
- Birth Certificate (photocopy) will be required
- Letter from employer/ Identity card.
- However, secret key will not be required.

4.4 The Architectural Design of SPLC

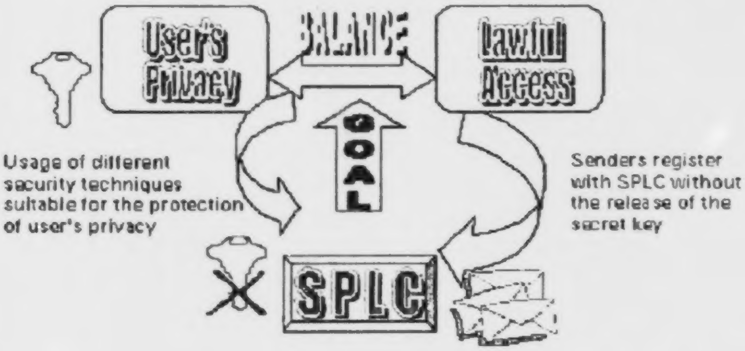
User's Privacy
BALANCE
Lawful Access
GOAL
Usage of different security techniques suitable for the protection of user's privacy
Senders register with SPLC without the release of the secret key
SPLC

Figure 5 shows the architectural design of SPLC

From figure 5, the goal is to balance the interest of users and public safety by protecting users privacy and the safety of the public from criminal activities. First and foremost, making it compulsory for users to register with *SPLC* (an organization) each time before they transmit information from one end to the other. However, users do not need to release the encryption key to *SPLC* in order to maintain their total privacy. The user will hold the encryption key.

4.5 Goal Realized - SPLC

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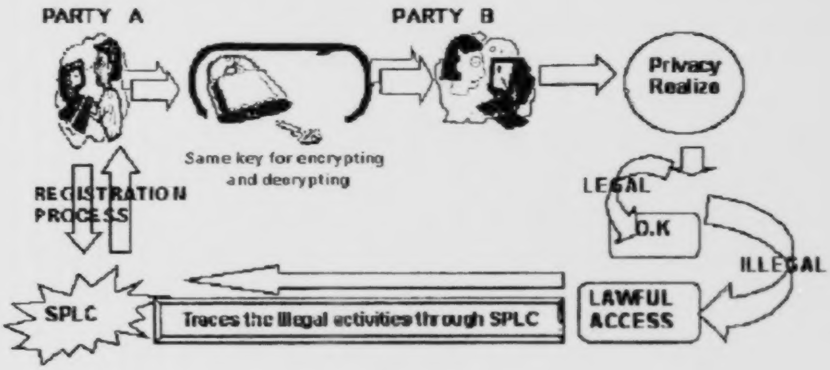
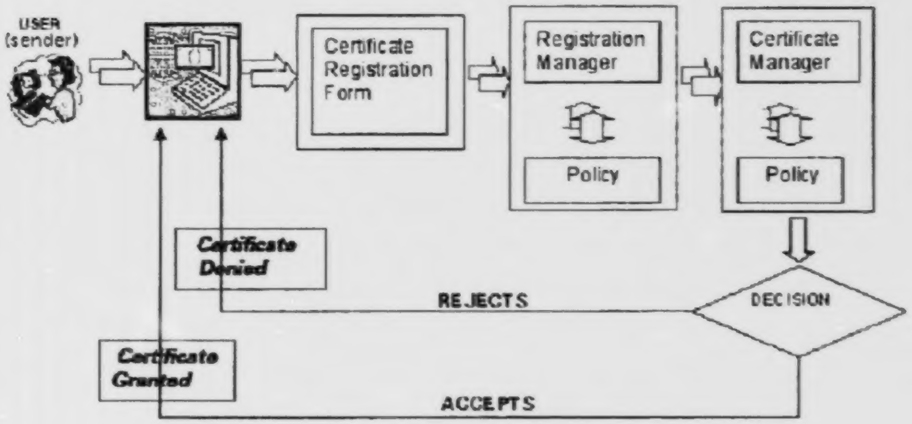

PARTY A
PARTY B
Privacy Realize
Same key for encrypting and decrypting
REGISTRATION PROCESS
LEGAL
O.K
ILLEGAL
LAWFUL ACCESS
SPLC
Traces the illegal activities through SPLC

Figure 6 shows the process of SPLC

First and foremost we must have it at the back of our mind that this problem of conflict between individual privacy and lawful access is a social/legal problem not a technical problem and the problem can be solved by using a legal/social approach. From figure 6 above, shows the procedure of how the goal of using the SPLC to balance the users' privacy and public safety could be realized, when Party A has the intention to send a secret information to party B, Party A will need to register with the proposed organization called **SPLC** and his will give a go ahead or a certificate to the Party A before he can send the secret information and once Party A receives the go ahead from SPLC, then Party A can send the secret information to Party B, by using the available secured technique to protect the secret information. The privacy of such secret information will be realized. However, the secret key of such secret information will not be given to any organization or party.

Moreover, in order to protect the safety of the public, the law enforcement agent will be on the look out for people that send unlawful or illegal information and this can be known when a crime is committed.

When a crime is committed the law enforcement agent will investigate the sender of such illegal information. Such criminal can be apprehended so easily since any party that wants to send secret information must first register with SPLC. The law enforcement agent will contact the SPLC to investigate and trace any suspected crime and criminals.


USER (sender)
Certificate Registration Form
Registration Manager
Policy
Certificate Manager
Policy
Certificate Denied
REJECTS
DECISION
Certificate Granted
ACCEPTS

The above figure 7 shows the Registration Process

Step1. The User fills enrollment form served by the Registration Manager, and submits the request.

Step2. The Registration Manager scrutinizes the submitted form and confirms the User's authenticity to register for the transmission of the secret information.

Step3. The registration Manager's subjects the request to it's own policy checking, and write his comment before passing it on to the Certificate Manager.

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Step4. The Certificate Manager accepts the form and acts on the comment passed by the Registration Manager.

Step5. The Certificate Manager subjects the request to its own policy checks. If the request passes Certificate Manager's policy. It signs the request immediately.

Step6. However, if the request does not pass the Certificate Manager's policy checks the Certificate will not be granted but be denied.

4.6 The Registration Manager's Policy

- Make sure the submitted form is completely and correctly filled without omission.
- Confirms that the sender of the secret information has never had police/crime records.
- Confirms whether the sender has sent secret information before or not.
- Checks if the sender is a member or representative of a terrorist organization.
- Confirms the date of birth of the sender, which should not be less than 21 years of age.
- Checks if the purpose of sending the secret information is genuine.
- The scrutinized form should be passed down to the certificate manager once it has been certified and accepted by the registration manager.
- The rejected form will be returned to the sender with the message unapproved.

4.7 The Certificate Manager's Policy

- Certificate manager checks whether the registration manager is authentic.
- Certificate should be granted if it is in conformity with the rules and policies of the SPLC or otherwise rejected.

5.0 Conclusion:

This research work principally focused on the possible solution to the conflict between the privacy of users and the public safety/lawful access. Our goal in this research work is to solve this social problem by using *SPLC - Solution to Privacy and Lawful access Conflict* to protect the interest of users and also that of the public against crime. This will eradicate the problem of lack of confidence on minds of users as touching their privacy most especially in this era of progress in electronic commerce.

Moreover, this proposition gives room for the law enforcement agents to apprehend any illegal information transfers from senders to receivers, which will eventually protect the public safety.
As of recent and in the nearest future, electronic commerce will continue to be at the leading edge of technological forces that are shaping the world economy. Electronic commerce however has the potential force to bring transformation to the way we work, the way we shop and the way we interact with government. The progress in electronic commerce is considered to be inevitable. However, in order to realize this, absolute consideration and concentration should be given to the issue of privacy. This is the more reason we proposed our idea -SPLC. Our intention is not to eradicate TTP-Trusted Third Party but in order to balance the interest of the generality. SPLC possesses a balanced measure to both the interest of users as touching their privacy and that of the law enforcement agent.

Finally, we think and believe this is the time to face the reality as touching the user's privacy and Lawful access conflict, by proposing our idea - SPLC-Solution to Privacy and Lawful access Conflict.

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[7] SPLC is the ***S***olution to ***P***rivacy and ***L***awful access ***C***onflict - a proposition to balance the conflict between individual privacy and lawful access.

[8] Privacy is a security principle that protects individuals from the collection, storage, and dissemination of information about themselves and the possible compromises resulting from unauthorized release of that information *Computer Security Basics* By Deborah Russell and G.T. Gangemi Sr. 1992 page 418

Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

GRECOS-Global Responsibility, Encrypted Coordinate, Operating System

George Richard Baier

Abstract

www.paetec.com

Executive Summary

The Internet as we know it today has evolved over the last decade into an extremely powerful societal tool that helps the world to communicate. It is now commonplace for people to go onto the Net and purchase books, fine tune their stock portfolios, schedule their airline flights, and even replenish their stock of contact lens. In the years ahead the Internet will continue its inexorable journey deeper into our day to day lives. The activities that are supported by the Internet will invariably stratify into many levels of importance and utility as usage increases. As the dependence on the Web for information and execution of work become more critical, there will be less tolerance for hackers and the accompanying virus' that have recently shaken the confidence of the computing world.

- What can be done to secure the Internet from these attacks?
- Can we protect the internet from cowardly and potentially evil attacks?

The focus of this paper will concentrate on the practices and methods that can be applied using existing technology to retool the Internet, making it more secure, reliable, and better utilized than it can claim to be today. This paper has been chosen as the means to introduce a new development in the way we look at Internetworking. We shall call it GRECOS™.

Before we fix it, however, let us assess the Internet in its' current form.

The Internet- Assessing the Current Platform

As stated previously, the Internet as it exists is an extremely powerful global communications tool. As any universally available device, there are people who will respect it and others will abuse it. Just as there are individuals who would never think of painting graffiti on a subway car, there are others who live for the opportunity to express themselves on that silvery canvas. The Internet in it's current form provides a universal platform for expression. This can take the form of art, music, prose, and beauty of the written word. Like the subway artist plying his trade in the cover of darkness, the Internet has also evolved into a vehicle for any shameless and anonymous manifestations a mind can conjure. It is the power of anonymity that attracts cowardice. It is also this anonymity that allows hackers of every skill level to attempt to bring this Internet to a state of diminished utility and brings it's reliability into question. In assessing that there is a need to address this problem in the existing framework, we observe that there have been very successful efforts made to control and inhibit this activity.

Law enforcement authorities across the globe have coordinated their efforts to find and prosecute these offenders, primarily through the ability to trace their ISP or Internet Service Provider. What will the successful method to track offensive behavior be as the access methods change, become wireless, and emanate from so many different satellites? How will we they be able to trace IP (Internet Protocol) addresses and link them to the crime? As our access technology improves, and driven by market present forces it certainly will, the ability to protect and secure the Internet will be far more difficult. There are signs that same terminology that the weather service uses to alert citizens of hurricane will be the standard for alerting the computing public to attacks. Ironically the SARC or Symantec Anti-virus Research Center has instituted the classification of viruses from Category One, being the most dangerous to a Category Five being the mildest variety[1]. Are we destined to become as powerless against the effects of viruses as we are against the weather? The current methodology appears to indicate that the vast amount of energy applied to solving the problem of computer viruses is to respond to attacks and "out smart" the hacker. If you understand them you can stay with them. Anti-virus software has been our best defense against attack. The assessment of this approach is to admire the effort that is being made to defend the Internet, but to wonder at the same time if it is the only course available for us to follow.

Setting Objectives for Improvement

Having assessed the current platform, establishing objectives for improvement are important for the long term health and well being of the Internet. It would be the objective of any program to improve the Internet that these issues be considered.

- Freedom from censorship
- Cost and Availability of required technology
- Vulnerability from attacks
- Training component and cost in migrating to a new platform

Freedom has always been one of the hallmarks of the Internet. We have gotten use to the access to a mass audience, to have a platform to declare one's viewpoint or opinion, without fear of retribution, or penalty. A concern could be that the introduction of accountability could infringe, or at least a chilling effect on free expression.

Cost of technology could put the improvements needed to facilitate improvement of the Internet out of reach to many current users.

Immunity from future attacks can never be guaranteed, there will always be system maintenance requirements to anticipate. How can we protect the integrity of the new network from intruding parties, those who hop on someone's computer without permission?

Change rarely occurs without some pain. A new Internet may require a learning curve with associated costs involved.

A Strategy for Change- GRECOS™

The need has been established for a means of accountability for this area that has created the problems within the Internet. A new strategy to create a platform that enhances the benefits of the Internet as a global instrument, yet does not submit itself to the same attacks from within it's own base of users. There most likely is no one strategy that can resolve all of the problems discussed here. A partial solution proposed here **GRECOS™**, or **Global Responsibility, Encrypted Coordinate, Operating System.** As a new strategy, GRECOS™ establishes a Networking tool that is enhanced with the capability of supplying the **exact location** of each individual user in the network.

Conceptually,the coordinates for location are received from the GPS receiving devise mounted integrally within the laptop or desktop unit. The coordinates giving us an exact location are **encrypted** in such a way as to protect them from being misused. The encrypted location information is then placed in the header of the IP cell. This new header is the key for navigating the GRECOS™Internet. Access is denied from any information streaming in without the proper header. Encryption decoding capability is necessary in establishing a sources' location.

At the heart of the GRECOS™is a GPS receiver. GPS was developed by the U.S. Department of Defense. The Global Positioning System is a series of 24 satellites orbiting the earth at high altitudes. Satellites transmit signals that allow one to determine the locations of GPS receivers with great accuracy. The receivers can be fixed on the Earth, in moving vehicles, aircraft, or in low-Earth orbiting satellites. GPS is used on land, sea and air navigation, surveying and other applications where exact positioning is desirable. The GPS device engineered for the GRECOS™ application would need to be small and robust. It would be powered by the computer to which it was installed and would produce and output a digital signal corresponding to it's global position. This signal would be subject to an encryption algorithm which could be included as part of the devise or handled elsewhere in the computer. The encrypted coordinates would be imbedded as part of the IP header and sent out to the Wide Area Network. The network would recognize that the header contained the appropriate coordinate information required for entry, and access would be rendered. GRECOS™ could be incorporated with new standards for internet protocols as they are being considered.

Why would we pursue this technology?

- Special Decoding centers could be established to quickly determine location of a user. This would be modeled after the SS7 system to which quickly identifies IXC carriers in our public switched telephone network (PSTN).
- The user of this network has the security of knowing that others on the network are accountable for their actions and that their whereabouts are revealed as part of the 'contract' of subscription.
- E-commerce would benefit from having partial encryption capabilities to allow for a blind verification of location.
- Emergency 911 type response would be enabled through the Internet, providing housebound invalids, stranded travelers, or anyone in need of help with a means of access to help.
- A paradigm shift would have us migrate towards GPS for the purposes of getting around without need for maps.

Historically used for military and recreational applications, i.e. LORAN position devises to track schools of fish. The GPS devises were much too large for consideration in a GRECOS™ application. The size of GPS receivers has progressively shrunk to make GRECOS™ a real solution. Recently a group from the University of Frankfort[2], Institute of Zoology, harnessed GPS equipment complete with a power source and datalogging capability for the purpose of tracking the migration patterns of pigeons(see figure#1). "Our team has developed a recorder that consists of a GPS hybrid board, an onboard datalogger, a DC-DC converter, a small patch antenna, a lithium battery, and an additional microprocessor controlling the GPS according to user-defined parameters. **The device, wrapped in thin plastic, weighs 33 grams** plus 4.5 grams for a harness -- still rather heavy for pigeons. It can store about

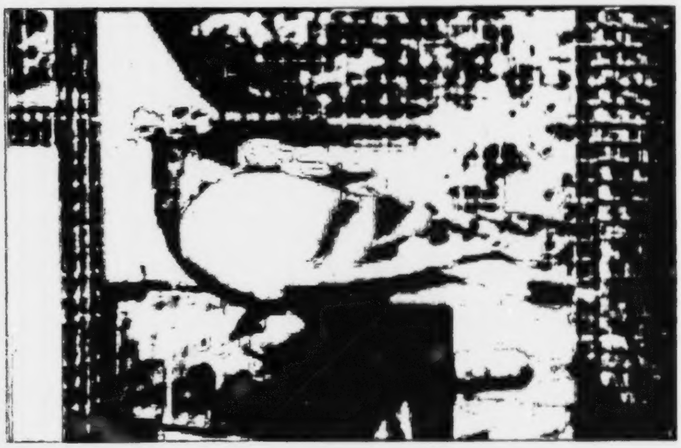

Figure #1 Pigeon equipped with GPS receiver and datalogger.

90,000 positions (one position per second) and operates for three hours."[3] In a laptop or desktop, the battery would be unnecessary as would any datalogging equipment. Consequently, the unit would not become a cumbersome addition in any way.

GRECOS™ embraces the Internet by accommodating the IP structure. The technical discussion of exactly how the GRECOS™ system will work is reserved for determination by a standards committee. The current structure of the IP datagram does, however, avail us with the opportunity to imbed information relating to the service type, the Source IP Address, and also the IP Options (see figure #2).

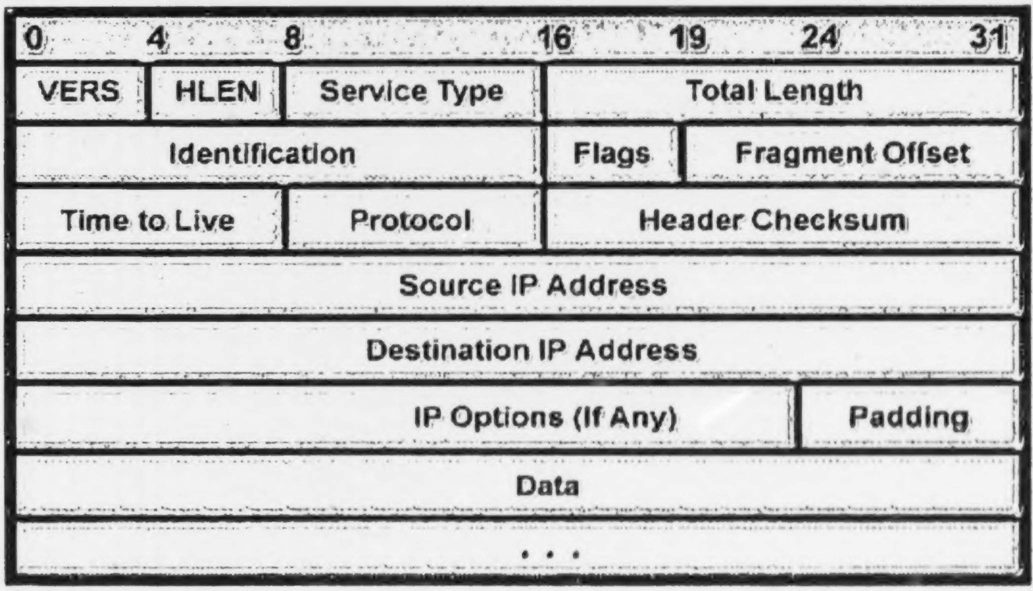
0
4
8
16
19
24
31
VERS
HLEN
Service Type
Total Length
Identification
Flags
Fragment Offset
Time to Live
Protocol
Header Checksum
Source IP Address
Destination IP Address
IP Options (If Any)
Padding
Data
. . .

Figure #2

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The integration of encrypted geographic coordinates (from Global Positioning System (GPS) devises capable of being installed in laptops, desktops, and other access mechanisms) into the IP Datagram provides us with a unique and powerful marriage of existing technology. This enhancement to our current Internet framework can provide the security and accountability it currently has surrendered to its own currently open structure. By imbedding the coordinates into the IP datagram, we have succeeded in introducing a new value proposition to the existing Internet.

GRECOS™ is needed to accomplish the following:

- Give Law enforcement a new apprehension tool .
- Provide a Secure Service Level for Critical Internet Applications.
- Enable a Global Emergency Response "911" mechanism.
- Unveil the shroud of anonymity from it's current structure.

Outstanding Issues/Conclusion

The GRECOS™ service does not limit freedom, it only introduces accountability. There would be no censorship associated with this service except that which would make one think twice before trying to infect another user with a computer virus or commit any other illegal act. The cost of implementing this service is reasonable and most likely would drop with the sheer volume of users that the service creates. As stated, the technology exists and would only need to be adapted to the application after standards are written. The cost of not adopting the service is higher.

Any new approach would require a change in the way the Internet operates, but from a user's perspective, the transition is seamless. The only changes involve hardware and internal signaling, in which the user has no involvement. The new network, protected by GRECOS™ should never be considered immune from attack. The structure is inherently better at self detection and policing than the current version. Since participation in the service is voluntary, the secure level of service that it represents will attract those who appreciate what the Internet provides commercially. GRECOS ™ provides a partial solution that will work extremely well for those who need a high quality and secure network. This is not a panacea, and this presentation is in no way anything more than a platform for consideration. Having said that, consider the impact that caller ID has had on the behavior of the obscene phone caller or harasser. The use of GRECOS™ can have that similar effect. Once accountability is introduced, behaviors change. There still will be challenges that come from unauthorized use of GRECOS™ provisioned equipment. Thieves are apt to steal the use of this equipment and leave before they could be traced. This is a real problem to consider. A multi-pronged attempt to control the misuse of the Internet is our major goal. Utilizing tracer-routes and other IP detective tools must continue to be applied in this effort. GRECOS™ will provide a unique set of parameters towards the effort to police the Internet. Injecting physical and geographic coordinate parameters onto a dimensionless void of cyberspace has the potential of making it a more powerful and safer medium than we know it to be today.

Endnotes

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[3] Institut of Zoology, Universität Frankfurt, Frankfurt, Germany Karen von Hünerbein
Eckhard Rueter Rueter EPV Systeme, Minden, Germany

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Mr. Baier is married with three wonderful children between the ages of 18 and 22.

He is currently employed at PaeTec Communication, an integrated communications provider (ICP) based in New York and serving 27 markets in the US. He is currently matriculating part time in a Master of Science in Telecommunication Program at State University of New York, Institute of Technology, Marcy, N.Y. and anticipates completion in 2001. Previous career paths included involvement in energy conservation and process control instrumentation applications for industrial clients. Living in Cazenovia, NY, a local affiliate of Habitat for Humanity International was started in 1984 as a grassroots organization formed to build decent housing with participating low income families. Mr. Baier is a founding member and currently serves as President.

Back to proceeding page **Back to the sessions page**

$ Economics & Financing

Tuesday, 16 January 2001
1100–1230

T.2.6 The Digital Divide: How Can Developing Nations Jointly Pursue Telecommunications and Internet Development

Location: Tapa III

Chair: ROBERT FRIEDEN, Professor of Telecommunications, Pennsylvania State University, *USA*

This session will consider whether nations can accrue both telecommunications and Internet development objectives, or whether the two goals cannot always occur jointly. Many nations in the region only recently have achieved double-digit telephone line penetration per one hundred inhabitants. Can these nations use improved telephone line density to establish an improved telecommunications/information processing infrastructure? The session will address this question from both technological and business perspectives.

Presenters:

Toward Digital Dividends in the Developing World: Lessons in Telecommunications Policy and Practice (ABSTRACT)

HEATHER HUDSON, Professor and Director, Telecom Management & Policy Program, University of San Francisco, *USA*

The Digital Divide and the Distribution of Wealth: Guidelines for Formulating Reasonable Public Policies (ABSTRACT)

MILTON MUELLER, Associate Professor, Syracuse University, School of Information Studies, *USA*

The Digital Divide Beyond the Globalization Hype: Confronting the Challenges and Exploiting the Opportunities for African SMMEs in the Information Economy (ABSTRACT)

DERRICK L. COGBURN, Assistant Professor, School of Information, University of Michigan, *USA*

Toward Digital Dividends in the Developing World: Lessons in Telecommunications Policy and Practice

Heather E. Hudson

Abstract

1. Introduction

The transition to a digital economy requires affordable access to reliable communications, along with other facilities such as computers and intelligent terminals, and the ability to put these tools to productive use. While there are gaps in both access to ICTs (information and communication technologies) and the skills to use them associated with income, ethnicity and/or rurality in industrialized countries, this so-called "digital divide" is much more pronounced in developing countries, where access to information and communications technologies (ICTs) remains much more limited.

Table 1: Internet Access by Region [1]

	People Connected (millions)	Global Percentage of People Connected	Percentage of Global Population
Canada and U.S.	97.0	56.6%	5.1%
Europe	40.1	23.4	13.7
Asia/Pacific	27.0	15.8	56.2
Latin America	5.3	3.1	8.4
Africa	1.1	0.6	12.9
Middle East	0.9	0.5	3.6

Table 1 shows the gap in Internet access between the industrialized and developing worlds. More than 85 percent of the world's Internet users are in developed countries, which account for only about 22 percent of the world's population [2]. Of course, Internet access requires both communications links and information technologies, particularly personal computers or networked computer terminals. While there is still much less access to telecommunications in developing countries than in industrialized countries, at present, the gap in access to computers is much greater than the gap in access to telephone lines or telephones. High income countries had 22 times as many telephone lines per 100 population as low income countries, but 96 times as many computers. However, as prices for computers continue to decline, access may become more related to perceived value than to price. See Table 2.

Typically, a high percentage of developing country residents live in rural areas (as much as 80 percent of the population in the least developed countries), where access to communication networks is much more limited than in urban areas. See Table 3. It should be noted that this table overestimates rural access because the "rest of country" includes everything except the largest city. Also. facilities are not likely to be evenly distributed throughout the country, so that in poorer nations there may be many rural settlements without any communications infrastructure.

Table 3: Access to Telecommunications [3]

Country Classification	Teledensity (Tel Lines/100)		
	National	Urban	Rest of Country
High Income	46.0	52.9	43.8
Upper Middle	13.7	25.7	11.5
Lower Middle	9.7	22.1	7.2
Low Income	2.5	6.5	2.3

Table 2: Access Indicators [4]

Country Classification	Tel Lines /100	PCs /100	Internet Hosts/10,000	Internet Users/10,000
High Income	54.1	22.3	28.1	92.0
Upper Middle	13.4	2.9	8.4	55.9
Lower Middle	9.7	1.3	1.9	19.0
Low Income	2.5	0.2	0.1	0.9

2. Telecommunications and Development

2.1. Information is critical to development.

The theoretical underpinning of research on the impact of information and communications technologies in general is that information is critical to the social and economic activities that comprise the development process. Information is obviously central to activities that have come to be known as the "information sector" including education and research, media and publishing, information equipment and software, and information-intensive services such as financial services, consulting, and trade. But information is also critical to other economic activities ranging from manufacturing to agriculture and resource extraction, for management, logistics, marketing, and other functions. Information is also important to the delivery of health care and public services. If information is critical to development, then information and communications technologies, as means of accessing, processing, and sharing information, are links in the chain of the development process itself [5].

In general, the ability to access and share information can contribute to the development process by improving:

- *efficiency*, or the ratio of output to cost (for example, through use of just-in-time manufacturing and inventory systems, through use of information on weather and soil content to improve agricultural yields);
- *effectiveness*, or the quality of products and services (such as improving health care through telemedicine);
- *reach*, or the ability to contact new customers or clients (for example, craftspeople reaching global markets on the Internet; educators reaching students at work or at home);
- *equity*, or the distribution of development benefits throughout the society (such as to rural and remote areas, to minorities and disabled populations). [6]

2.2. Telecommunications is necessary but not sufficient for development.

The results of numerous studies have shown that telecommunications is *necessary but not sufficient* for development. The reality is that there are many other factors that contribute to economic development, including:

- other infrastructure: particularly electrification and transport
- a skilled workforce
- cost of operations including facilities and labor.

Regions with all of these advantages may well be able to attract new jobs by encouraging investment in modern and competitively priced telecommunications. Nebraska in the U.S. and New Brunswick in Canada have attracted a thriving call center industry because of their combination of a reliable and relatively low cost workforce and high quality telecommunications. Western Ireland has become the "back office" for many U.S. companies, building on its assets of a well educated and comparatively low cost labor and high quality infrastructure, including telecommunications. Indian software developers have sold their services overseas by contracting to write computer code which is transmitted to overseas high tech companies, typically via dedicated satellite networks.[7]

2.3. The larger the network, the greater its value.

A basic rule of connectivity known as Metcalfe's Law is that the number of connections and thus the potential value of the network increases almost as the square of its users. Theodore Vail, the early visionary president of AT&T, understood this principle, that expanding the network would generate more value for customers and more revenue for AT&T. (In contrast, many PTTs have grown slowly, keeping rates relatively high. They offered a service elites could afford, but did not provide the greater access that could have contributed to national economic growth as well as revenue for the PTT.)

Metcalfe's Law has relevance for policy as well, because it, in conjunction with the evidence of the role of telecommunications in socio-economic development, suggests that the policy makers' top priority should be ensuring availability and affordability of networks so that anyone who wants to use them can do so. Strategies designed to increase access rather than to protect incumbent operators are likely to contribute more to economic growth.

3. Planning and Policy

3.1. Telecommunications planning should not be done in isolation.

Telecommunications planning should be done in conjunction with ministries responsible for other sectors and in consultation with relevant agencies at the state and local level to establish priorities. For example, an east African country had a policy of rolling out public call offices (PCOs) according to the government's administrative hierarchy, from province to region to district to village. On paper in the capital this plan seemed rational, but in practice it missed what should have been higher priorities. For example, there was no access to telecommunications at an intersection of two major national highways, which was the most the most important transport junction in the country. A neighboring country had no provision in its national plan to extend telecommunications services to game lodges, although tourism had become the top foreign exchange earner for the country.

It would appear that transition to a market-driven telecommunications sector would solve such problems in that facilities would be installed where there was predicted to be significant revenue, such as truck stops, guest houses and other businesses. Yet, operators themselves may assume that too little revenue is at stake in rural and impoverished areas to make it worth consulting locally about demand and placement of facilities (see below). If service is poor or access too limited (for example, few outlets selling prepaid phone cards), the result will be not only lack of as much access as the licence requirement was designed to provide, but a self fulfilling prophecy of low revenue.

3.2. The goals should be separated from the means.

Policy makers and regulators have a tendency to confuse the goals with the means. The role of the government should be to set goals and not to determine how they should be achieved. For example, in the U.S., the FCC initially tried to dictate the size and technology to be used in two-way VSATs, in order to minimize interference. Innovative engineers were able to convince the FCC to set the technical specifications and let the industry determine how to meet them. The result was smaller and cheaper terminals than would otherwise have been developed.

An example in India would be the requirement to upgrade village PCOs for data communications. Perhaps the goal should be stated as providing access to e-mail and the Internet in every village. The means may range from upgrading PCOs for data communications, to establishing public access in schools or community buildings, or in privately run business centers or tea shops. The government's role would be to ensure that reliable and affordable networks are available to each community.

3.3. Start with thirsty horses.

National information infrastructure plans typically call for availability of Internet access in every community. However, not all communities may have identified needs for these services. Given limited resources, it may be best to start with pilot projects that would test out both the technologies and techniques for putting them to use. Communities that have requested access, and can demonstrate their commitment, for example, by donating space for the equipment or nominating candidates to be trained as outreach staff, should receive priority. This approach of identifying potential innovators and early adopters may be called "looking for thirsty horses" (as in "You can lead a horse to water, but you can't make it drink).

4. Regulation

4.1. Assuring independence of the regulator may be difficult.

The common wisdom is that regulators must be independent both of the industry and of the political process. In countries that began with the PTT model, the concern is to make the regulator independent from the PTT to avoid conflict of interest between operator and regulator, a necessity in a competitive environment where equitable rules must be set and enforced for all operators. However, a problem with this approach is that typically employees who once worked for the PTT now work for the regulator, making it inherently difficult to avoid bias in assumptions or decisions.

It may be possible to guard against explicit bias favoring the former PTT, but perhaps a more significant danger is that regulatory employees will start with assumptions of what is feasible and practicable based on their PTT experience. Strategies that could address this problem would be to include professional staff such as economists from other ministries, use external consultants without ties to the former PTT, and request public filings and comments so that all relevant views may be considered.

4.2. If the government is slow to act, regulation becomes policy.

A distinction is often made between policy making, typically carried out through a government ministry or department with responsibilities for telecommunications, and regulation, to be carried out by an "independent" body, i.e. that is not related to the operator nor directly responsible to a minister. However, in telecommunications, the distinction between regulation and policy quickly becomes blurred, because of the pace of technological change and market pressures in the communications industry. Some countries [8] have made a functional distinction in placing much more limited responsibility in the regulator as an adjudicator and arbitrator, while retaining responsibility for licensing as well as policy making within the ministry. Although perhaps attractive conceptually, a danger of this approach is that the government will not respond in a timely manner, so that the Indian telecommunications industry will lag foreign industries or lose opportunities to enter new markets. One strategy to avoid this problem is to set firm enforceable deadlines for decisions on license applications and other time-sensitive matters. This approach was used in the US 1996 Telecommunications Act which set specific deadlines for the FCC to complete various rulemakings and directives required to implement the Act.

4.3. Effective regulation requires participation.

It is often thought that the issues in telecommunications policy and regulation are so technical and often arcane that most people would have nothing useful to contribute to the decision-making process, and that public participation would add little of value. However, all regulatory agencies are overworked and understaffed, and cannot find or analyze all the data that would useful to guide decision making. Major users are likely to have well thought out views on the impact of proposed regulations or the need for reforms that would enable the telecommunications sector to better serve their industries. The ability of small users and consumers to contribute may seem less likely; it may take some time for their representatives to get up to speed on telecommunications technology and economics. However, the contribution of such groups may also provide perspectives that might otherwise be overlooked.

A problem for consumer groups is the cost of tracking the issues and preparing testimony or other interventions. In order to ensure that such consumer perspectives are represented, in some countries [9] the regulator pays the costs of participation in hearings by consumer organizations that contribute evidence which would not otherwise be available.

4.4. Old distinctions may no longer be relevant.

Classifications and distinctions which once were useful may no longer be relevant. For example, telecommunications services have been classified by the ITU and its members into fixed, mobile and broadcasting. Regulators typically issue separate licenses and approve separate tariff structures for fixed and mobile services, yet these distinctions have become blurred. Mobile telephone service was designed for communication while in vehicles; however, modern cellular and PCS systems are used for personal communications, and can often be considered a substitute for fixed network connections. In many developing countries, wireless has become the first and only service for many customers who never before had access to a telephone.

4.5. Long term periods of exclusivity do not serve the public interest.

In a liberalized environment, the length and terms of operator licenses can impact the pace of growth of networks and services. Regulators typically face choices concerning how long to protect incumbents to enable them to prepare for competition, and how long to grant periods of exclusivity or other concessions to new operators to minimize investment risk. Yet exclusivity and long time periods may be the wrong variables to focus on if the goal is to increase availability and affordability of telecommunications services. Instead, a transparent regulatory environment with a "level playing field" for all competitors and enforcement of the rules is cited by investors as key to their assessment of risk.

A few countries have granted licenses with as much as 25 years of exclusivity, although 10 years or less seems more common. Even 5 to 10 years seems like a lifetime given the rapid pace of technological change, with Internet time measured in dog years (seven to a calendar year). Some jurisdictions [10] have negotiated terminations of exclusivity periods with monopoly operators in order to enable their economies to benefit from competition in the telecommunications sector.

4.6. Users will find a way...

Protecting dominant carriers that continue to charge prices far above those for comparable services in other countries not only penalizes users, as noted above, but drives the more agile to find alternatives. The users' response to unaffordable prices is increasingly to bypass the network. People with telephones in most developing countries can access callback services to make international calls at a fraction of the price charged by their own international operators.

Many monopoly operators claim that callback is siphoning off revenues that they need to expand their networks, which would also probably create more jobs. However, the relationship is not so simple. For example, an Internet service provider (ISP) from a small west African country pointed out that without callback, he would not be in business. He needs a relatively inexpensive international connection to the Internet in order to provide affordable Internet access for his customers. By using bypass, he is creating new jobs in value-added services as an Internet provider, as well as providing an important information resource for economic development of the country. OFTA, the Hong Kong regulator, negotiated an early termination to Hong Kong Telecom's monopoly on international services, which was to last until 2006. Before the termination of the monopoly, [11] OFTA effectively introduced international competition by licensing competitive local companies which offered callback access.

4.7. Oversight with enforcement will be needed.

The marketplace is generally the best mechanism for bringing innovative and affordable services to most users, including the majority in rural areas (see below). However, there will be an ongoing need for oversight to monitor progress toward meeting targets, to enforce compliance with performance standards, and to review and revise benchmarks. For example, there will be a need for monitoring to determine whether there are disparities in access, quality of services, or pricing that need to be addressed. Otherwise, operators may not meet targets that are conditions of their licenses in areas that they think will not be profitable, or install facilities but not maintain them adequately if they assume the revenue generating potential is low. Operators must also be held to their license conditions if licensing is to be an effective means of extending access. [12]

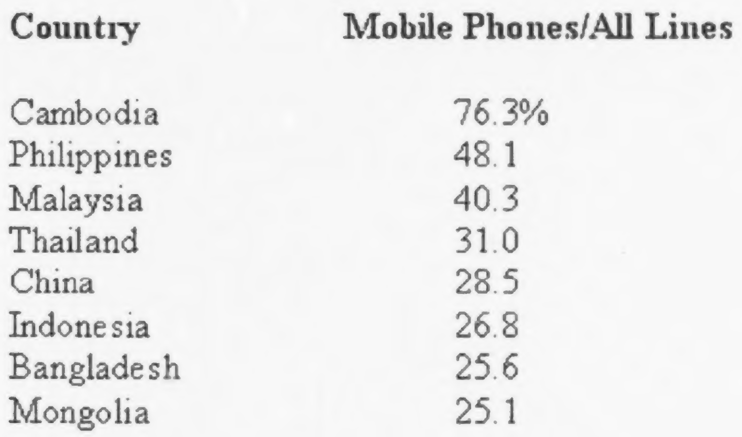
5. Extending Access

5.1. Fixed lines close large gaps too slowly.

In developing countries without sufficient wireline infrastructure, wireless personal networks can be used for primary service. In China, there are more than 10 million wireless customers. In Uganda, within one year of licensing a second cellular operator, attractive pricing and aggressive marketing of prepaid service using rechargeable phone cards have resulted in there now being more cellular customers than fixed lines in the country. For most of the new subscribers, their cellphone is their first and only telephone [13]. Other developing countries where wireless is used as a primary service include Colombia, Lebanon, Malaysia, the Philippines, South Africa, Sri Lanka, Thailand, and Venezuela [14]. Table 4 below shows Asian developing countries where wireless mobile lines contribute significantly to teledensity, providing 25 percent or more of all subscriber connections.

Cellular operators in South Africa were required to install 30,000 wireless payphones within five years as a condition of their license [15]. This policy, plus rollout requirements placed on Telkom, the monopoly fixed operator, contributed to a significant improvement in access to telephone service. By 1998, 85 percent of South Africans, including 75 percent of those living in rural areas, said that they had access to a telephone. In townships and rural areas, access typically meant an available payphone within a short walk.

Table 4: Mobile as Percentage of all Telephone Lines: [16]



Country	Mobile Phones/All Lines
Cambodia	76.3%
Philippines	48.1
Malaysia	40.3
Thailand	31.0
China	28.5
Indonesia	26.8
Bangladesh	25.6
Mongolia	25.1

5.2. Resale is an effective means to increase access.

Authorization of resale of local as well as long distance and other services can create incentives to meet pent-up demand even if network competition has not yet been introduced. Franchised payphones have been introduced in Indonesia, India, Bangladesh, and other countries. in order to involve entrepreneurs where the operator has not yet been privatized and/or liberalized. Indonesia's franchised call offices known as Wartels (Warung Telekomunikasi), operated by small entrepreneurs, generate more than $9,000 per line, about 10 times more than Telkom's average revenue per line [17]. Franchised telephone booths operate in several francophone African countries; in Senegal, private phone shops average four times the revenue of those operated by the national carrier [18]. In Bangladesh, Grameen Phone has rented cellphones to rural women who provide portable payphone service on foot or bicycle to their communities.

Resale of network services can also reduce prices to customers. Most interexchange carriers in the US are actually resellers that lease capacity in bulk from facilities-based providers and repackage for individual and business customers, offering discounts based on calling volume, communities of interest, time of day and other calling variables.

5.3. Universal access goals must be moving targets.

Universality has been defined in various countries in terms of population density, distance and time. Some countries set targets of public telephones within a radius of a few kilometers in rural areas; others aim to serve every community or settlement. China, India, Mexico, Nepal, and Thailand, for example, aim for at least one telephone per village or settlement [19]. The ITU's Maitland Commission called for a telephone "within an hour's walk" throughout the developing world.

The concept of universal access continues to evolve, both in terms of services that should be universally included and in our understanding of access, which includes *availability, affordability,* and *reliability*. Universal access should therefore be considered a dynamic concept with a set of moving targets. Rapid technological change dictates that the definitions of basic and "advanced" or "enhanced" services will change over time, while the unit of analysis for accessibility may be the household, the village, municipality, or even institutions such as schools and health centers. Thus, for example a multi-tiered definition of access could be proposed, identifying requirements within households, within communities and for education and social service providers. For example:

- **Level One**: community access (for example, through kiosks, libraries, post offices, community centers, telecenters)
- **Level Two**: institutional access (schools, hospitals, clinics)
- **Level Three**: household access.

In industrialized countries, the goal has been to provide basic telephone service to every household, with the assumption that businesses and organizations could all afford access to at least this grade of service. However, for Internet access, the U.S. is applying community and institutional access models. The U.S. Telecommunications Act of 1996 specifies that "advanced services" should be provided at a discount to schools, libraries, and rural health centers [20]. "Advanced services" are currently interpreted as Internet access. In the future, it is likely that "advanced services" will be redefined, perhaps to include access to new generations of services available through the Internet or its successors.

In developing regions, the need for services besides basic voice is now spreading beyond urban areas, businesses and organizations, to small entrepreneurs, NGOs (nongovernmental organizations) and students, driven by demand for access to e-mail and the Internet. E-mail is growing in popularity because it is much faster than the postal service and cheaper than facsimile transmission or telephone calls. For example, a message of

2,000 words takes 10 minutes to read over a telephone, two minutes to send by fax, and about 4 seconds to transmit via 28.8 kbps modem [21]. Such services can be valuable even for illiterates. A Member of Parliament from Uganda stated that his father sent many telegrams during his lifetime, but could neither read nor write. Local scribes wrote down his messages and read them to him. Similarly, "information brokers" ranging from librarians to telecenter staff can help people with limited education to send and access electronic information.

Telecenters equipped with personal computers linked to the Internet enable artisans, farmers and other small entrepreneurs to set up shop in the global marketplace [22]. South Africa is funding the installation of telecenters equipped with phone lines, facsimile, and computers with Internet access through a Universal Service Fund; South Africa now plans to provide Internet access to government information and electronic commerce services through post offices. Many other countries are extending public access to the Internet through telecenters, libraries, post offices, and kiosks.

5.4. If subsidies are needed, they must be targeted.

The traditional means of ensuring provision of service to unprofitable areas or customers has been through cross subsidies, such as from international or interexchange to local services. However, technological changes and the liberalization of the telecommunications sector now make it impracticable to rely on internal cross subsidies. As noted above, customers may bypass high priced services using callback services or Internet telephony.

In a competitive environment, new entrants cannot survive if their competitors are subsidized. Therefore, if subsidies are required, they must be made explicit and targeted at specific classes of customers or locations such as:

- **High cost areas:** Carriers may be subsidized to serve locations that are isolated and/or have very low population density so that they are significantly more expensive to serve than other locations. This approach is used in the U.S. and has recently been mandated in Canada.
- **Disadvantaged customers:** Subsidies may target economically disadvantaged groups that could not afford typical prices for installation and usage. Some operators may offer interest free loans or extended payment periods to assist new subscribers to connect to the network. In the U.S., the Lifeline program subsidizes basic monthly services charges for low income subscribers. The subsidy funds come from a combination of carrier contributions and surcharges on subscriber bills. Some 4.4 million households receive Lifeline assistance. Also in the U.S., the Linkup program subsidizes connection to the network for low income households.

Funds for subsidies may be generated from several sources such as contributions required from all carriers: for example, a percentage of revenues, a tax on revenues or a surcharge on customer bills. Subsidies may also come from general tax revenues or other government sources. Some countries with many carriers rely on settlement and repayment pooling schemes among operators to transfer payments to carriers with high operating costs. For example, the U.S. Universal Service Fund is mandated by the Federal Communications Commission (FCC) but administered by the carriers through the National Exchange Carriers Association (NECA), and transfers funds to subsidize access lines to carriers whose costs are above 115 percent of the national average [23].

In Poland, over 7,885 localities were connected between 1992 and 1996 with funding of US $20 million from the state budget [24]. In 1994, Peru established a rural telecommunications investment fund, FITEL (Fondo de Inversion de Telecomunicaciones), which is financed by a one percent tax on revenues of all telecommunications providers, ranging from the country's newly privatized monopoly operator, Telefonica/ENTEL to cable TV operators. Since established, it has generated an average of US$450,000 per month; growing by US$12 million annually.[25] Private sector operators may apply to FITEL for financing.[26]

6. Rural Issues

6.1. Rural demand may be much greater than assumed.

In designing networks and projecting revenues, planners often assume that there is little demand for telecommunications in rural areas. Similarly, telecommunications service providers may be reluctant to extend services to poorer populations who are assumed to have insufficient demand to cover the cost of providing the facilities and services. Their forecasts are typically based solely on the lower population densities than are found in urban areas, coupled with a "one size fits all" fallacy that assumes all rural residents are likely to have lower incomes and therefore lower demand for telecommunications than urban residents. However, some rural residents may need telecommunications to order parts and supplies, check on international prices, and arrange transport of their produce to foreign markets. There may be significant demand from government agencies and NGOs operating in rural areas to administer health care services, schools, other social services, and development projects.

A study for the World Bank estimates that rural users in developing countries are able collectively to pay 1 to 1.5 percent of their gross *community* income for telecommunications services [27]. The ITU uses an estimate of 5 percent of *household* income as an affordability threshold [28]. Using a conservative estimate, 20 percent of households in low income countries such as India could afford a telephone.[29]

Just as income may not fully explain demand for information technologies and services, lack of access to telephone service cannot necessarily be attributed to lack of demand or purchasing power. For example, in many developing countries, television sets are much more prevalent than telephones. In industrialized countries, both TV sets and telephone lines are almost universally available. However, in middle income countries there are twice as many TV sets as telephone lines, while in low income countries, there are more than 5 times as many TV sets as telephone lines (see Table 2). In India there were about 3.3 times as many TV sets as telephone lines in 1999.

It appears that where television is available, a significant percentage of families will find the money to buy TV sets. Thus, even in the poorest countries, there may be much more disposable income available than per capita GDP data would indicate, and there may be significant demand for other information services.

Table 5: Access to Telephone Lines and Television Sets

Country Classification	Tel Lines /100	TV Sets /100	Ratio TV Sets/Tel lines
High Income	54.1	61.9	1.1
Upper Middle Income	13.4	26.3	2.0
Lower Middle Income	9.7	22.7	2.3
Low Income	2.5	13.1	5.2

Derived from: ITU, *World Telecommunications Development Report*, 1998.

Other approaches may also be used to gauge demand for information services. For example, the presence of video shops indicates significant disposable income available for television sets, video cassette players, and cassette rentals. Telephone service resellers (such as in Indonesia, Senegal and Bangladesh), local cable television operators (common in India) and small satellite dishes on rural homesteads and urban apartments (common in Eastern Europe and many Asian countries) also signal demand and ability to pay for information services.

Revenues from rural telephones may also be greater than expected, especially if incoming as well as outgoing traffic is included. For example, it is important to anticipate the influence of family ties on calling patterns. Communities where many people have left to seek work in the city or overseas may have high volumes of incoming traffic. For example, Filipina domestic workers call home from Hong Kong, Singapore and Malaysia; Indians and Pakistanis call home from the Middle East, and miners in South Africa call their families in other parts of South Africa or neighboring countries such as Mozambique and Zimbabwe. There may also be extensive calling among family members scattered in villages throughout a rural region. The significance of rural toll traffic seems particularly important in estimating rural revenues in India, where revenues from village phones with STD are apparently nearly 50 times as high as revenues from VPTs without STD. [30]

6.2. Rural areas may not be as expensive to serve as is often assumed.

It is typically assumed by both operators and regulators that the costs of providing telecommunications in rural areas are unavoidably high, and, coupled with low demand, render rural services necessarily unprofitable. While costs per line are bound to be higher than in urban areas, creative strategies for design and implementation may reduce costs.

Topography and climate are important considerations in system design. A microwave network may be an appropriate solution for plains and valleys, but satellite service is likely to be more suitable for mountainous areas. Designing for available transportation facilities and labor can also reduce costs. For example, the Alaskan carrier GCI specified that VSATs built for operation in Alaska villages must be designed to be flown into villages in Cessna Caravan aircraft, as there are no roads to most villages. Maintenance and troubleshooting are to be done by bush pilots who regularly fly into the villages. Bell Canada trains local technicians to do basic telephone installation and troubleshooting in northern Canadian communities. Other strategies such as the use of prepaid stored-value telephone cards can save time and money by eliminating the need to collect coins from pay phones (while also preventing pilferage).

Modular design that allows for adding capacity when required will also reduce costs of upgrading service.

Demand may increase not only with population growth, but also if there are changes in the economy or demands for new service, such as Internet access. A digital microwave system installed in the Australian Outback reached capacity much earlier than expected not only because of its design (which required remote switching for village-to-village traffic) but also because of unanticipated demand for fax and then Internet access. Upgrading the network required a complete overbuild. In the Marquesas in the South Pacific, satellite earth stations have been installed for telephone service and TV reception, but circuit capacity is very limited. When asked whether additional capacity could be added if demand increased (for example, for Internet access for schools), a site engineer said "There will never be more demand here." [31] Never assume never.

6.3. Rural benchmarks need not be set lower than urban benchmarks.

A persistent assumption is that "something is better than nothing"is the only policy that is technically feasible or economically justifiable for rural areas. However, a corollary of the lessons above, that revenues in rural areas may often be higher and costs lower than assumed, is that is no longer technically or economically justifiable to set rural benchmarks lower than urban benchmarks for access - both to basic telecommunications and to the Internet.

For example, the U.S. Telecommunications Act of 1996 sets a standard of reasonable comparability: rural services and prices are to be *reasonably comparable* to those in urban areas. While the US and other industrialized countries must upgrade outdated wireline networks and analog exchanges in rural areas, developing countries can leapfrog old technologies and install fully digital wireless networks. Thus developing country regulators can also adopt rural comparability standards to avoid penalizing rural services and businesses in access to information services. For example, in the Philippines, after extensive discussion, both government and industry representatives agreed on rural benchmarks including digital switching, single party service, and line quality sufficient for facsimile and data communications. The industry representatives stated that the new digital networks they were installing in rural areas met those specifications, and that older networks should be brought up to those standards. [32]

6.4. Some rural areas may be viable for commercial franchises.

Some countries grant monopoly franchises to rural operators. For example, Bangladesh has licensed two rural monopoly operators; they are allowed to prioritize the most financially attractive customers and charge an substantial up-front subscriber connection fee. The Bangladesh Rural Telecommunications Authority (BRTA) is profitable, even though it has to provide at least one public call office (PCO) in each village that requests one. [33]

Although in most countries a single carrier provides both local and long distance services, it is also possible to delineate territories that can be served by local entities. In the U.S., the model of rural cooperatives fostered through the Rural Utilities Service (formerly Rural Electrification Administration) has been used to bring telephone service to areas ignored by the large carriers. As noted above, wireless technologies could change the economics of providing rural services, making rural franchises much more attractive to investors. As a result of availability of funds from the RUS for upgrading networks, rural cooperatives in the US typically provide more modern facilities and better Internet access than provided by large telephone companies serving rural areas.

Other countries are opening up rural areas to competition as part of national liberalization policies. Argentina allows rural operators to compete with the two privatized monopolies, Telecom and Telefonica. Some 135 rural cooperatives have been formed to provide telecommunications services in communities with fewer than 300 people. [34] Finland's association of telephone companies has created several jointly-owned entities that provide a range of rural, local and long distance services in their concession areas, in competition with the national operator [35]. In Alaska, a second carrier, GCI, competes with AT&T Alascom to provide long distance services in rural and remote areas. This competition has benefitted Alaskan schools in gaining access to the Internet. GCI has assisted school districts in applying for E-rate subsidies for Internet access, apparently viewing this initiative as a win-win opportunity for both schools and the telephone company.

7. Implementing the Vision

The above analysis assumes a broadening of information infrastructure issues to include rural as well as urban access, a range of levels and targets for services, and pricing to ensure affordability of access to a range of telecommunications services including access to the Internet. It involves an analysis of the potential benefits of access to education and social services, the impact of geographical as well as income-related disparities, and the potential benefits of affordable access to information for social and economic development. A conclusion that can be drawn from the above analysis is that changing the policy environment to create incentives to serve previously ignored populations may significantly increase access among these groups.

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Footnotes

[1] Derived from Henry et al., The Emerging Digital Economy

[2] It should be noted that Japan and Australia are included in the Asia/Pacific in this chart; the estimate in the text includes them with industrialized countries of Europe and North America.

[3] Derived from International Telecommunication Union. *World Telecommunication Development Report 1998.* Geneva: ITU, 1998.

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[8] For example, India has placed licensing responsibility with the Division of Telecommunications Services in the Department of Telecommunications rather than with the Telecommunications Regulatory Authority of India (TRAI).

[9] For example, the Canadian Radio-Television and Telecommunications Commission (CRTC) in Canada, and the California Public Utilities Commission in the United States.

[10] For example, Hong Kong and Singapore.

[11] Personal communication, July 1997.

[12] It appears that this has not been the case for village phones required to be installed by new fixed service providers (FSPs) in India. TRAI notes that only 12 village public telephones (VPTs) had been installed by three FSPs in the first 24 months, while a total of 42,841 VPTs were required under the terms of the licenses.

[13] Personal interview, Uganda Communications Commission, Kampala, November 1999.

[14] ITU, 1998, p.49.

[15] ITU, 1998, p. 50.

[16] Source: ITU, World Telecommunications Development Report, 2000.

[17] ITU, 1998, p. 77.

[18] ITU, 1998, pp.77-8.

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[21] Hegener, M. quoted in ITU, *World Telecommunication Development Report*, 1998, p. 80.

[22] Petzinger, Jr., Thomas. "Monique Maddy uses Wireless Pay Phones to Battle Poverty." *Wall Street Journal,* September 25, 1998, p. B1.

[23] See www.neca.org, and information on the Universal Service Fund on the FCC's website, www.fcc.gov.

[24] ITU, 1998, p. 78.

[25] ITU, 1998, p. 79.

[26] Kayani, Rogati and Andrew Dymond. *Options for Rural Telecommunications Development.* Washington, DC: World Bank, 1997, pp. 63-4.

[27] Kayani and Dymond, p. xviii.

[28] ITU, 1998, p. 35.

[29] ITU, 1998, p. 37. It should be noted that this calculation appears to assume even distribution of income throughout the society at higher income levels, which is not necessarily true.

[30] TRAI, p. 49.

[31] Personal interview, December 1996.

[32] Meeting at Department of Transport and Communications attended by the author, Manila, January 1998.

[33] Kayani and Dymond, p. 18.

[34] Kayani and Dymond, p. 18.

[35] Kayani and Dymond, p. 19.

Back to top of page **Back to the sessions page**

The Digital Divide and the Distribution of Wealth: Guidelines for formulating reasonable public policies

Milton Mueller

Abstract

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There is nothing specifically "digital" about the "digital divide."

Major inequalities in the capacity to access, own, or utilize information and communication technologies exist within nations. The inequalities are even more noticeable across nations. Studies in the United States decry the fact that in some poverty-stricken urban or rural areas, half the population does not have telephone service. In China, on the other hand, municipal officials in certain cities are justifiably proud of the fact that half the residents now have telephone service; in the outlying rural villages there might be a penetration ratio of 3 percent.

Fashionable slogans about the existence of a "digital divide" tend to divert our attention from a critical fact. The same disparities existed, and often still exist, in older communication technologies such as the telephone, television and sound production facilities. Indeed, the same inequalities show up in completely different but equally important sectors, such as health care, education, transportation, or pharmaceuticals.

A flurry of research on the digital divide in America has developed a fairly detailed profile of the groups who are falling behind [1]. They are younger than 25 years old, have lower income, less education, are more likely to be single parents, especially households headed by women, or to be in remote rural areas. The so-called "information-rich" conform closely to our concept of rich people in general: they are more likely to be white or Asian, have higher incomes, be more educated, and live in the suburbs. The divide, to repeat, has little to do with digital technology per se and everything to do with the distribution of wealth.

This paper makes two essential arguments. First, it contends that the digital divide, to the extent that it exists, is a product of disparities in the distribution of wealth and therefore policies designed to remedy the so-called divide should acknowledge that they are proposing to redistribute wealth. To put it even more baldly, universal access policies are mostly about taking money away from some people and giving it to others. I argue that we need to moderate our expectations about what redistributing wealth can accomplish. Subsidies to promote more universal access to telecommunication and information resources cannot substitute for the kind of economic growth that can finance the construction of a ubiquitous infrastructure. Policies targeted at the digital divide are not a substitute for an economic development plan, nor can they alter the basic opportunity structure of society. At best, they are simply a way of making things slightly more balanced. Public discourse about the digital divide will become much more focused and rational when everyone explicitly accepts this fact.

The second step in the argument is to call attention to the fact that wealth redistribution is a political process. Advocates of universal access need to become more sophisticated about the constraints and risks of politically mandated wealth redistribution. Once the universal service (or digital divide, depending on your verbal preference) policy is acknowledged to be a form of wealth redistribution, some fairly clear guidelines emerge as to what those policies can reasonably be expected to do-and not to do-and what pitfalls to watch out for.

Wealth and Telecommunications Access

The subject of wealth and its relationship to telecommunications penetration is a good place to start. The strong positive correlation between per capita wealth and the geographic and social penetration of telecommunication and information services has been evident for decades [2]. Rich societies have the highest levels of telephone penetration and poor societies have the lowest. The correlation works across almost all forms of media: newspapers, appliances, etc. Wealth causes penetration levels of IT to approach universal levels, not the other way around.

Some econometric studies suggest that economic growth and telecommunications growth are related in a cycle of mutual causation [3]. That statistical relationship, however, can only be found to exist in historical data of already-developed economies such as the United States. The data suggest that a society with an expanding economy also needs to expand its telecommunications infrastructure, and that if the infrastructure expansion does not keep pace with the growth of the economy, growth and wealth-creation will be impeded.

But it is implausible to propose that the causal direction can be reversed. Haiti or Burma cannot transform themselves into wealthy societies simply by building an extensive, universal telecommunications network or adopting advanced information technologies. Where would they get the capital to build it? Even if some generous international agency simply donated the billions of dollars required (a not very realistic scenario), the mere physical presence of an advanced information infrastructure would mean little unless it was efficiently and organically related to the economic and social needs of the country. The investments put into the infrastructure must generate a payback quickly enough to generate a self-sustaining cycle of growth. The residents of the country must know how to operate, use, and maintain the services in a way that actively contributes to their competitive advantage in the domestic and global economy. Otherwise, the infrastructure is nothing but an inert mass of wires, plastic and metal.

In short, the most broadly effective policies are simply to grow household wealth and to build an open, competitive economy that is able to efficiently supply information goods and services at prices that are affordable to ever larger numbers of people. Everything else is secondary.

Inequality and Redistribution

Most advocates of attacking the digital divide would not be content to let growing household wealth produce higher aggregate levels of technology diffusion, however. They would point out that even in advanced economies with high levels of penetration there are major inequalities in the distribution of information goods and services [4]. They are right, of course. Quite apart from household income disparities, there are also major differences in the cost of extending a network to different geographic areas of a country. Left to its own devices, a market economy would probably reflect those cost disparities, to the detriment of some of the people living there. Nearly every advanced economy, and most developing ones, engage in some form of hidden cross-subsidy or explicit wealth redistribution in order to reduce or eliminate the cost disparity between rural and urban areas.

The above discussion reveals that contemporary universal service policies are really about the proper scope of the redistribution of wealth. Such policies are designed to reduce or eliminate access disparities among different groups in the same society. Why belabor this point? Because all too often, universal service advocates are unwilling to acknowledge this simple fact and understand its implications.

- They concoct elaborate and inflated claims for universal service policies; for example, that they will magically ameliorate the differences between rich and poor or stem the economic decline of rural areas.
- They invent woefully inaccurate historical myths about the contribution of government policies to infrastructure development.
- They persistently ignore the fact that throughout the world, most of the work of extending new communications technologies to the broad population has been done by commercial investors, not by redistributionist policies.

That leads to the second part of the argument. By explicitly identifying universal service policy as a form of wealth redistribution, a much clearer mental framework is created for the definition and assessment of public policies. That framework is summarized as follows:

1. First, universal service policies, as forms of wealth redistribution, can only make marginal contributions to the distribution of telecom resources;

2. Second, major wealth-redistribution policies must be based on political bargains that reflect the perceived self-interest of major social powers;

3. Third, wealth redistribution is most effective when it is narrow and targeted, and most fair when its costs are not hidden;

4. Fourth, it makes no sense to apply universal service policies to new or emerging technologies.

1. Redistribution policies are only relevant at the margin.

Universal service policies can only ameliorate inequalities at the margin. Employed as a supplement to normal commercial development, they may increase penetration by a few percentage points or extend geographic distribution a bit more than it would have been otherwise. No society has ever built an entire infrastructure on the basis of redistributionist policies, however. Universal service policies can be used to supplement a market-oriented, business-driven infrastructure development strategy, but the real work of development is going to be done by commercial interests and follow commercial imperatives. This was certainly the case in the United States. The REA helped to finance telephone exchanges in remote areas, but its overall impact on rural America was tiny compared to the massive, unsubsidized extension of the public network that took place in the early 1900s because of the competitive struggle between independent telephone companies and the Bell system [5]. The regulatory cross-subsidies that kept residential telephone rates artificially low from 1965 on also had a marginal impact on the overall rate of telephone penetration. They coincide in time with the growth of household penetration from 85 percent to 92 percent, but penetration was growing rapidly before they were instituted and continued to grow as the FCC phased them out [6].

The same is true of Internet access. Five years ago, some of the more aggressive advocates of universal service-oriented intervention were eager to include Internet access in a list of subsidized services. Since then, the commercial ISP industry in the United States, driven entirely by normal business incentives, has done an impressive job of delivering toll-free dial-up Internet access to almost every area in the United States. An extensive study by Shane Greenstein showed that only 12% of the U.S. population lives in counties with only one or no ISP [7]. It remains to be seen whether this progress will continue or whether there will be some residual pockets of the country that require some sort of subsidy. Either way, the contribution of universal service policy to the spread of the Internet will be marginal compared to the impetus given by industry.

2. Wealth redistribution is based on political bargains

Even when redistribution of wealth seems to be justified, it is wise to keep in mind its limitations. One of those limitations is the important fact that wealth redistribution by the state is never a pure expression of altruism, but emerges from a political process. In order to utilize the government's power to reshuffle money, political coalitions must be formed and bargains made. Such political processes are no more exempt from self-interest than the pursuit of profit in the commercial world. Granted, political processes structure self-interested interactions in a very different way than do market transactions. But one is still dealing with self-interest. Any universal service program of a significant scale is going to bear the imprints of local telephone monopolies, long distance companies, educational institutions, rural politicians, and all the other "usual suspect" lobbying groups.

That point has been made by Harmeet Sawhney in an essay comparing the development of universalistic objectives in education to universal service in telecommunications [8]. Sawhney showed that the concept of universal public education was little more than that-a concept-until a coalition of societal groups with very different interests converged around the idea. Some of the objectives of the coalition-such as the idea of "Americanizing" immigrants and the need to keep children out of the labor market-no longer seem so noble, but they were essential to the realization of the program.

Another constraint on policy is that the political bargains that underlay redistribution can be difficult for a society to extricate itself from. The political bargains that sustain the program can survive long after the need for the program has gone away.

3. Wealth redistribution should be explicit, targeted, and competitively neutral.

Politically-mandated wealth redistribution is usually a zero-sum game. Such policies do not create wealth; they simply take it away from some people and give it to others. In many instances, they destroy wealth by re-allocating it in ways that are manifestly inefficient. For that reason, it makes sense to carefully limit the scope of such programs. Subsidies should not be broad and all encompassing, but narrow and targeted. The public has a right to know exactly how much money it is paying for the program.

For example, telephone "lifeline" programs, which offer lower-priced telephone access to poor households and require some form of means-testing to qualify, have had a major impact on telephone penetration in low income households. In terms of its effects, its cost, and general considerations of social justice, the Lifeline programs compare very favorably to the pre-AT&T divestiture "universal service" cross-subsidies, which used long distance revenue to lower the price of local access on a blanket basis. The latter approach to subsidies generated massive distortions in the structure of the industry and huge economic inefficiencies. It was also a hidden subsidy, and it was almost impossible to know who, aside from the telephone companies, was a net beneficiary of it and why.

4. Do not impose universal service goals on new or emerging media forms.

If digital divide policies are understood to be a form of wealth distribution, it makes little sense to impose universalist goals on new or emerging media forms. One can equalize access only to well-established goods and services *after* a mass market has developed and service levels have been standardized. No matter how egalitarian one's sentiments, there is simply no way around the fact that new technologies must originate somewhere and gradually diffuse to the rest of society.

To insist that every time a new technology appears it must instantly be subject to universal service obligations would impose insurmountable social costs upon governments and private industry. Even worse, it would nip in the bud the process of reducing the cost and redefining the form of a technology in ways designed to penetrate larger markets. (Imagine what would have happened had the government decided to subsidize the distribution of PCs around, say, 1982).

To return to the Greenstein study of Internet service development, perhaps in a few years we will be able to determine that the market for Internet access has equilibrated at a point where five percent of the most remote rural areas simply are not being served by ISPs. Then, given the importance of Internet access to participation in society and economy, it may make sense for government to redistribute wealth to subsidize ISP access in those areas. But it is also possible that such policies will prove to be unnecessary. Rural ISPs may spread into almost every nook and cranny of the country. Or the development of low earth orbiting satellite systems (LEOs) may create competing broadband wireless infrastructures that provide affordable access everywhere. In that case, a universal service policy designed to extend access to rural areas is simply a waste of money or, worse than that, a way to create a class of beneficiaries who will lobby ferociously to maintain the subsidies long after they are needed.

Conclusion

The academic and policy literature on the digital divide has proliferated to such a degree that the topic seems to have lost its moorings. This essay is an attempt to bring the discourse back down to earth. Universal service policy is about wealth redistribution. The effects of such social engineering are no different in the sphere of telecommunications and information than they are in any other area, such as housing or medical care. There is nothing magic or special about the information economy that exempts its goods and services from the laws of supply and demand, or that nullifies the lessons we have learned about the welfare state. Putting networks or computers into the hands of poor people will not magically transform them into effective, literate users.

The redistribution of wealth has some manifest positive and negative aspects. It can help to ameliorate some glaring social inequalities and improve the living standards of those on the lower rungs of the social hierarchy. But if it is taken too far it can destroy individual initiative and freeze economic progress in its tracks. In the author's opinion, wealth redistribution is best confined to a minor role as a supplement to the overall workings of the market economy, and deployed in a carefully targeted manner. Whatever subsidies exist should be visible to those who have to pay for them, and the burden of subsidies should not tilt the competitive playing field in favor of one supplier or class of suppliers over another.

Notes and References

[1] R. Lentz, "The e-volution of the digital divide in the US: A mayhem of competing metrics." *Info* 2, 4 (August 2000), 355-377.

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Back to top of page **Back to the sessions page**

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Dr. Mueller has conducted scholarly research on telecommunications and information policy since 1982. His research focuses on property rights, institutions and regulation in telecommunication and information industries.

Dr. Mueller has been studying and participating in Internet governance debates since 1995. His comprehensive account of the formation of ICANN was published by the journal Info in December 1999. In 1998 he presented one of the first empirical studies of domain name - trademark conflicts at the 26th Annual Telecommunications Policy Research Conference. He is one of the founding members of ICANN's "non-commercial" constituency within the Domain Name Supporting Organization, and an active participant within the ICANN working group on new top-level domain names. He is listed as a WIPO Domain Name Panelist available to resolve disputes under ICANN's Uniform Dispute Resolution Policy.

Mueller's book, "Universal Service: Competition, Interconnection and Monopoly in the Making of the American Telephone System" (MIT press, 1997) set out a dramatic revision of our understanding of the origins of universal telephone service and the role of interconnection in industry development. He has also published books on telecommunications development in China, digital convergence, and numerous research papers on radio spectrum property rights, interconnection, and telecommunications liberalization.

Mueller received the Ph.D. from the University of Pennsylvania, Annenberg School, in 1989.

Back to proceeding page **Back to the sessions page**

The Digital Divide Beyond the Globalization Hype: Confronting the Challenges and Exploiting the Opportunitiesfor African SMMEs in the Information Economy

Derrick L. Cogburn

Abstract

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1. Overview

Two of the key characteristics defining this historical period are the twin concepts of Globalization and the Information Economy. While these concepts are becoming increasingly prevalent in the scholarly and popular literature, there is little consensus on their precise meaning. In most cases, the analytical focus is primarily on the increased interdependence of financial markets. However, the fundamental transformation engendered by these processes goes beyond global financial integration to embody a wide range of social, political, economic, technical and cultural processes. It is affecting nearly all of the world's people, societies and economies, creating tremendous challenges and opportunities in its wake.

As these processes continue to unfold, a widening gap has emerged in terms of access to information and communications infrastructure, human capacity, and effective influence over the global policy making and regime formation processes for this new historical period. Increasingly this gap has been characterized as the "digital divide," a term popularized by the 1999 study conducted by the National Telecommunications and Information Agency (NTIA) of the United States Department of Commerce. This gap exists both within and between countries and is particularly acute for the countries of Africa and other parts of the developing and less industrialized world.

For many people, the period of Globalization and an Information Economy present considerably different visions for the future. On the one hand, those with a utopian vision of this period see Globalization and the Information Economy as the saving opportunity for the developing world. On the other hand, those with a dystopian vision see only chaos and oppression in a globalized world. This paper, presented in earlier forms at the inaugural session of the *African Development Forum*, hosted by the United Nations Economic Commission for Africa (ECA), in October 1999, and again in June 2000 at the African Association of Political Science (AAPS) conference on *Africa in the Global Economy*, presents an analysis of Globalization and the Information Economy and seeks to contribute to an African-driven agenda to confront these challenges. It argues that Globalization is neither inherently negative, nor inherently positive, but that we must go beyond the "hype" of globalization to develop strategic approaches to maximize the opportunities and meet the challenges its presents. Further, the paper argues that appropriate strategies to exploit the opportunities presented by these revolutionary developments in information and communications technologies and combat the digital divide, include three key areas: (1) "hard" and "soft" infrastructure development; (2) creative strategic human resources development; and (3) content creation and socio-economic development through small, medium and micro-sized enterprises (SMMEs).

Data for the paper are drawn from published reports (mostly from national, regional and international organizations), participant-observer and observer analysis, and structured interviews. The paper is divided into three sections and explores these important concepts generally, and especially as they relate to the Africa region. In section I, the paper focuses on an understanding of the background and context of Globalization, the Information Economy and Information Society, both defining and critically assessing these terms and movements. This section seeks to illustrate the depth of the transformation that the global political economy is currently experiencing with an analysis of key strategic responses. Section II, looks specifically at the challenges and opportunities presented by these developments with an understanding of current African realities. Finally, section III, discusses a way forward for the Africa region, including recommendations for national, sub-regional, regional, and global partnerships.

2. Globalization, the Information Economy and Society

Globalization, the Information Economy and Society-Contested Terms

These terms-Globalization, Information Economy, and Information Society-are among three of the most contested of recent times. "Globalization" means very different things to different people. Far beyond the narrow definition of Globalization that focuses primarily on financial integration, we have chosen to adopt a much more expansive definition. With this definition, we see that Globalization is not just about the deepening integration of financial markets, but includes a whole range of social, political, economic, technological, and cultural phenomena. We refer to these areas as the "spheres" of Globalization. These are the areas in which Globalization occurs

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and its impact can be found. One of the reasons that the Information Economy offers such promise to Africa is that each of these "spheres" of Globalization is supported by the application of electronic commerce.

In addition to the "spheres" of Globalization, there exist, through strategic planning, the opportunity for key geographic areas in Africa to exploit information and communications technologies and become "spaces" of Globalization. These spaces of Globalization are those areas (e.g., university campuses, companies, research facilities, organizations) that have the requisite information and communications technology infrastructure in place - including both hard and soft infrastructure - and are capable of applying that technology for the benefit of its constituents.

Fundamental Transformation in the Global Economy

The concept of an Information Economy is based on a fundamental transformation of the underlying structure of the global political economy. Many analysts are now arguing that this change is so definitive that it warrants the label of a techno-economic paradigm shift (Kodama 1994). This paradigm shift reflects changes in science, technology, the organization of business, production, learning and entertainment. Aspects of this transformation include: (1) the nature of the manufacturing company; (2) the changing nature of business dynamics; (3) major changes in the R&D activities of firms; (4) demand articulation in technological development; (5) technology fusion; and (6) institutional inertia. These changes are affecting nearly all sectors of the world-system, including intergovernmental organizations, the private sector, regional organizations, national states, and non-governmental organizations.

This period of change engenders a potential restructuring of power relations and the development of new forms of inequality in the world. It is possible that inequality in the Information Economy could go beyond a division between the so-called developed and developing countries to exacerbate intra-country divisions. Specifically, divisions could sharpen between those individuals possessing the knowledge, skills and abilities to contribute to the global Information Economy (wherever they may happen to be located) and those who do not possess such skills. Both of these categories of people are already located in both developed and developing countries. Increasing the interdependence between these global knowledge workers may lead to differing conceptions and conflicts of identity and roles.

Towards a Definition of the Information Economy

In defining the Information Economy, the author acknowledges the existence of a rich academic and popular debate on the subject. A key component of this debate, is the impact of Globalization on the formation of a "knowledge economy" in general, and the emergence of an "Information Economy" in particular. One characteristic of this current period of Globalization is the emergence of a new techno-economic paradigm, which some analysts call innovation-mediated production (Kenney and Florida, 1993). Within this framework, knowledge is increasingly embedded within the production process itself. One major issue that contrasts the knowledge economy from the industrial economy is that in many cases, the barriers to entry are much lower. In the new economy, information and knowledge become the most important factors of production. This mode of production characterizes the overall "knowledge economy," within which the "Information Economy" is playing an increasingly important role.

The author argues that the terms "Information Economy" and "Knowledge Economy" are very closely related and can be used synonymously in most cases. However, for the purposes of the paper, the author argues that the term "Information Economy" refers to a specific component of the emerging knowledge economy wherein the production of information goods and services dominates wealth and job creation.

Perhaps the most important development within the Information Economy is the economic explosion caused by global electronic commerce (e-commerce). Electronic commerce is the production, distribution, marketing, sale or delivery of goods and services by electronic means. This includes the integrated use of information and communications technologies (e.g., the global information infrastructure) as the medium through which goods and services of economic value are researched, designed, produced, advertised, catalogued, inventoried, purchased, distributed, accounts settled, follow-up support provided, and management information systems implemented.

Already, e-commerce is facilitating a process of dis-intermediation, where traditional intermediary functions are being replaced by new products and intelligent agents. However, many new markets are being developed for information goods and to cope with such a dramatic increase in the availability of information, new information-mediaries (infomediaries) are emerging. Whole new industries are emerging and new markets (and new types of markets) are being developed. Also, an unprecedented amount of information is being collected on individual consumers, allowing new and closer relationships to be forged between business and their customers, while at the same time creating new concerns about privacy in the on-line world.

The global Information Economy could be characterised as disciplinarian. Its interdependent nature ensures that "bad" decisions are punished immediately; and "good" decisions are rewarded with the same speed. With such a global, interdependent, knowledge-based economy, it is critical that appropriate mechanisms be developed at a global level to "govern" the global Information Economy-a global Information Economy regime.

Governance of the Global Information Economy and Society

A transformation of such historic proportions engenders substantial change in the mechanisms of governance as well. In this case, the international regime of norms, principles, values and enforcement mechanisms for this new economy are being developed as various societal actors around the world attempt to influence this process. Further, as this new regime is being developed, many societal actors are assessing, and reassessing their roles and strategies. Most likely, this new global Information Economy regime will be based upon the World Trade Organisation (WTO), the Geneva-based successor organisation to the General Agreement on Tariffs and Trade (GATT). Global market-access and a liberalised, rule-based, multilateral trading environment for tangible goods and intangible services are some of the key principles that already define this new economic order. The senior public, private and civil-society leadership in Africa and other developing regions must find ways to strengthen their voices in the high-level processes of regime formation if the rules of the new economy are to adequately reflect some of their interests (see Cogburn, forthcoming).

Impact on the National-State Model and Development

These changes have challenged significantly the idea of the nation-state model of governance. Of particular importance has been the need for strategic responses from the state to include participation and partnerships from all relevant societal actors (public, private and voluntary sector actors). Additionally, there is increased pressure on the state to develop a national legal and regulatory framework that supports private-public sector partnerships, and attracts foreign direct investment.

Global and Regional Responses to the Information Revolution

Over the past several years, numerous international organizations have worked to develop mechanisms for consensus between the relevant global state and non-state actors. These activities have had varying degrees of success. While there have been other consensus building activities, these listed below are deemed to have had the biggest impact on raising issues and presenting serious perspectives on how to address these challenges.

1st ITU World Telecommunications Development Conference (1994):

In response to these numerous challenges, countries and international organizations around the world have moved towards collective and individual efforts to harness resources, ideas and strategies. One of the earliest activities was the 1st World Telecommunications Development Conference (WTDC), hosted by the Development Bureau (BDT) of the International Telecommunications Union (ITU). Held in Buenos Aires, Argentina, the WTDC addressed the issue that was raised decades earlier in the Maitland Commission Report, chaired by Sir Donald Maitland. Known popularly as the "Missing Link" report, the Maitland Commission Report argued that there was a conclusive link between telecommunications penetration and socio-economic development. The WTDC reassessed this argument and ended with the same conclusions, adding that the gap between developing and developed countries had grown, not diminished, since the Missing Link. The conference attempted to harness the resources necessary to address this widening gap.

Group of Seven (G7) Ministerial Meeting on the Information Society (February, 1995):

Following this landmark meeting, ministers from the leading industrialized countries in the world gathered in Brussels, Belgium for the 1st Information Society Ministerial Meeting. These ministers were attempting to understand how they could work together to harness the increasing potential of information and communications technologies to address the increasing challenges facing their individual countries. Emerging from the G7 (actually the G8 with the inclusion of Russia at the meeting) Information Society ministerial meeting, was a series of Eleven Information Society pilot projects, that were designed to identify "best practices" and "lessons learned" from collaborative efforts amongst the G8 members. Several of these projects (namely the Government On-Line and the Global Marketplace for SMEs) actively encouraged participation from developing country members. Results from these pilot projects were analyzed continuously, and the European Commission established the Information Society Projects Office (ISPO) to further disseminate the lessons coming from the pilot projects

However, one major challenge for the meeting was that, as a G8 meeting, there was almost no participation from developing countries. The primary exception was that South African Deputy President Thabo Mbeki, was invited to speak "on behalf of the developing world." In his address, he argued that the participants at the meeting could not build a Global Information Society with only the eight participants sitting around the table, but that they had to involve a wide cross-section of the developing world. He offered South Africa as the host of such an initiative, and this challenge ultimately led to the G7/Developing World Information Society and Development Conference (ISAD) that will be discussed below.

Global Information Infrastructure Commission (February 1995):

While the G8 governments were meeting to develop their collaborative strategies for confronting the Information Society and exploring ways to involve the developing world, another important meeting was occurring in Brussels. A group of Chief Executive Officers from some of the leading information and communications companies in the world met to further challenge the G8 governments. As they launched their new organization, the Global Information Infrastructure Commission (GIIC), they argued that while Deputy President Mbeki was right in arguing for more developing country involvement in building the Information Society, it had to go even further. The GIIC members argued that governments alone would be unable to build the Information Society, and that private sector leadership was critical in partnership with the public sector if a truly "global" Information Society would be built. Their fifty members pledged to work for the next three years to help to promote the important role of the private sector in building the GII and to engage with public sector actors to help spread that message.

United Nations Economic Commission for Africa (1995/1996):

During the G7 ministerial meeting, Thabo Mbeki's remarks were well received. However, it took considerably longer for the G8 members to actually agree on a way to engage with the developing countries (in fact the agreement to participate in the ISAD conference only happened at their meeting in Novia Scotia). In the meantime, Africa did not wait for this potential blessing. In April 1995, the United Nations Economic Commission for Africa (ECA), hosted what has become known as a landmark meeting called the Telematics for African Development Symposium. The ECA is the largest UN presence in Africa. Headquartered in Addis Ababa, Ethiopia, it is one of three major regional organizations designed to facilitate regional socio-economic development in all 53 African countries (the other two being the Organization for African Unity, also located in Addis Ababa, and the African Development Bank, located in Cote D'Ivoire). This Telematics for African Development Symposium brought together numerous African experts in the use of information and communications technologies for development.

One result of the conference was a resolution for the Council of Ministers entitled "Building Africa's Information Highway" that called for an African response to the challenges of the Information Society. This resolution was adopted, and the Council created a High-Level Working Group (HLWG) on Information and Communications Technologies. Working mostly virtually (meeting physically only twice, once in Cairo and again Addis), the HLWG developed a high-level response for Africa called the African Information Society Initiative (AISI). The AISI was adopted by the Council of Ministers in May 1996 and was endorsed by the African Ministers of Communications meeting in Abidjan, Cote d'Ivoire to finalize the drafting of the *African Green Paper on Telecommunications*. One key component of the AISI is its focus on National Information and Communications Infrastructure (NICI) planning in each African country. AISI was given its public launch at in South Africa at a luncheon hosted by the GIIC at the Information Society and Development (ISAD) conference.

G7/Developing World Information Society and Development Conference (May 1996): As the result of Thabo Mbeki's challenge to the G8, the Information Society and Development Conference was hosted in South Africa in May 1996. As planned, a wide cross-section of developing countries participated in the ISAD conference, and challenged significantly the process of regime formation being led by the highly industrialized countries. Key issues placed on the global agenda were the following: (1) multi-purpose community information centers; (2) universal access; and (3) employment issues. Major plans to host a follow-up conference (ISAD II, proposed by the Arab Republic of Egypt) never materialized.

ITU Universal Right to communicate:

Moving in the same direction, Dr. Pekka Tarjanne, Secretary General of the International Telecommunication Union (ITU), proposed that another principle be added to the United Nations Universal Declaration of Human Rights; this being the Universal Right to Communicate. Several other organizations have now taken up this cry and are moving towards trying to include this principle on the larger global agenda. This addition elevates universal access from a luxury to a recognized basic human right.

Partnership for ICTs in Africa:

The AISI is grounded in the assumption that effective socio-economic development requires partnerships between many partners, including: (1) international development agencies; (2) donor agencies; (3) private sector actors; (4) non-governmental actors.

Global Knowledge for Development (June 1997):

In the vacuum left by the non-starting ISAD II, the World Bank initiated a similar conference to fill the void, but with a fairly different character. The Global Knowledge for Development conference was held in June 1997 in Toronto, Canada and organized by the World Bank and the government of Canada. The developed country orientation of this new conference was quite apparent. South African Minister of Communications Jay Naidoo, took the podium at one point and argued that "this conference is not the ISAD follow-up, that conference is yet to take place." Unfortunately, that conference has still not taken place (a second Global Knowledge conference was held in February 2000 in Malaysia, but there were significant confrontations between the developing and developed country contingents and international organizations).

2nd ITU World Telecommunications Development Conference (1998):

The tiny island of Malta played hosted to the second ITU World Telecommunications Development Conference in 1998. Attempting to assess the progress on the Buenos Aires Action Plan and to produce the program of work for the BDT for the next four years. Key issues gaining prominence at this conference was the addition to the agenda of a focus on women's access to information and communications technologies. The conference ended with the adoption of the Valetta Action Plan, hoping to consolidate the progress towards the development of an Information Society.

OECD Global Electronic Commerce Ministerial Meeting (1998):

In 1998, another distinctive shift began to happen in the movement towards an Information Society. While commercial issues have always been important, the increasing importance of Electronic Commerce (e-commerce) and a global Information Economy began to dominate discussions of an Information Society. In 1998, the Organization for Economic Cooperation and Development (OECD), which represents the 27 most industrialized countries of the world, hosted a ministerial level conference on global electronic commerce. A few developing countries were invited to participate in the event (including Minister Naidoo of South Africa), but many complained that their interests were clearly not important to the overall OECD agenda (the OECD has now planned a follow-up to this conference for July in the Middle East).

European Commission Information Society Technologies Conference (1998):

As an attempt to counter the perceived continued US dominance in information and communications technologies, the European Commission launched a new series of conferences for its members and strategic partners. These Information Society Technologies (IST) conferences started in 1998 in Vienna and were designed for focus on stimulating cooperative research through the 5th Framework Initiative for collaborative research.

Africa TELECOM (May 1998):

The International Telecommunication Union is primarily a politically-oriented inter-governmental organization. Its meetings are mostly intergovernmental negotiations on standards and agreements. However, it also has an alternative format for meeting called its TELECOM conferences. These conferences are able to raise issues and try to promote consensus in a less politically charged and threatening environment. World TELECOM is the centerpiece event, and it occurs every four years in Geneva, Switzerland. Given its quarter-annual format, it is often referred to as the "Olympics of telecommunications." After the World event, the conferences move around the world to the three major regions (Asia TELECOM, Africa TELECOM and Americas TELECOM). In May 1998, South Africa hosted the Africa TELECOM event and brought considerable attention to the perspectives of Africa in the movement towards and Information Society. Also during the Africa TELECOM, the Global Information Infrastructure Commission launched its first regional organization called GIIC Africa. GIIC Africa, with its motto of "Africanizing the Global Information Society with Private and Public Sector Cooperation," is designed to bring together 50 African private sector leaders to create additional momentum towards building the GII/GIS in Africa. Further, a grouping of African ministers of communications used the conference to issue its *African Connection* agenda, designed to further develop consensus amongst the African public sector on the importance of information and communications technologies to development.

3. Challenges for Africa in the Information Economy

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The Challenge for Africa in the Information Society

Africa has a number of specific challenges in moving towards an Information Society, not the least of which is being able to effectively harness its public, private and voluntary sector resources into an effective force for socio-economic development. Many of these challenges are simultaneous with a need to focus on the multiple issues of: (1) infrastructure development-both "hard" and "soft"; (2) human resources and capacity building; and (3) applications and content development. In addition, there is a significant need for analysis, best practices, lessons learned, knowledge management and "smart" partnerships between all societal sectors at national, regional and international levels. Dr. K.Y. Amoako, United Nations Undersecretary General and Executive Secretary of the United Nations Economic Commission for Africa, has articulated a very succinct strategy for African in the Information Society. He argues, "To move into the Information Society, Africa must be *clear* on what it wants and *make its desires clear to others*. If we are clear, if we have a compelling vision for ourselves, then it is likely that our choices will turn into our own reality. If we are not clear, then we will either be perpetual observers of the information highway or find ourselves on roads not fit for our needs" (UNECA, 1996).

Amoako and the AISI are pointing to some of the tremendous challenges facing Africa's entry into the Information Society. What can be done to confront these challenges and exploit the opportunities engendered by this monumental shift? Globalization and the Information Economy present unique opportunities for Africa. However, in order to capitalise on these opportunities, tremendous challenges must be overcome. Some of the key challenges include the following: (1) the development of information and communications infrastructure; (2) human resources development and employment creation; (3) the current African position in the world economy; and (4) insufficient legal and regulatory frameworks and government strategy. Each of these challenges is examined below.

The Imperative for Information and Communications Infrastructure

Numerous studies have shown that the benefits of an information age will not accrue to countries with an inadequate National Information and Communications Infrastructure (NICI). This NICI must be connected to and inter-operable with the emerging Global Information Infrastructure (GII). The African information and communications environment can be characterized by low telephone penetration rates, slow network growth, antiquated systems, sub-optimal reinvestment of profits, high pricing of private facilities, poor inter-city telephone links, and widely varying national network infrastructures. There are various, and sometimes competing, approaches to developing the NICI. Given that the access to information and communications infrastructure is so abysmal in the region, achieving "universal access" to information infrastructure is seen as the, *sine qua non* of widespread socio-economic development in an era of Globalization and an Information Economy.

Since universal access is so critical, numerous scholars, activist and development agencies have embraced the potential of Multi-Purpose Community Information Centres (MPCICs or telecentres) to help achieve those goals. Community information centres can serve as development vehicles in both developing and developed countries and can contribute to closing the infrastructure gap within developing countries. While still an incomplete definition, MPCICs may be defined as facilities in urban, peri-urban, and rural areas which utilise shared information infrastructure to provide access to a wide variety of public and private information and communication-based goods and services, and which support local economic and social development objectives. These facilities have a range of ownership and business models that may stimulate the growth of the local telecommunications market. In these facilities, a focus on replicability, sustainability and community ownership is critical.

In addition to the potential of MPCICs, a wide variety of new and alternative infrastructure possibilities exists. Some of these forms of alternative infrastructure include the following: (1) the new generation of Global Mobile Personal Communications by Satellite (GMPCS) systems; (2) floating and flying platforms; and (3) a multiplicity of local wireless solutions. These forms of infrastructure can facilitate the proverbial technological "leapfrogging" and are perhaps the best example of that often used and sometimes derided term. For example, developing countries, in most cases, do not have the same fixed investment in copper cable and thus can skip laying more of it in favour of going directly to fibre or another broadband solution.

Education, Employment and Human Capital in a New Economy

The rapid development of human resources and creating employment are also critical challenges facing Africa in the information age. Low levels of education and literacy are crippling Africa's ability to exploit the Information Economy. In many countries, the limited use of English has also been cited as an additional constraining factor.

The educational requirements for the Information Economy are increasing in complexity. However, some national development programs are still attempting to base their employment creation strategies on the perceived comparative advantage that comes from access to large numbers of cheap unskilled labour. The reality is that national and regional strategies should focus on enhancing and attracting a core of knowledge workers operating within the Africa region. This should be accomplished through both national and regional education and training and through incentives to attract the Africa Diaspora and other skilled knowledge workers into the region. However, in this process, we should take care to develop strategies to minimise the impact on the components of the population whose educational level and technical skills do not fit (and may never fit) the requirements of the new techno-economic paradigm of the Information Economy.

Africa in the Global Economy

With the emergence of Globalization and the movement towards an Information Economy heavily dependent on knowledge-based products and services, Africa has witnessed its already tenuous position in the global economy deteriorate even further. By almost any measure, Africa's current position in the world economy is near the bottom. Moreover the exports, on which Africa is so dependent, are confined mostly to primary commodities. These commodities account for over 90% of all African exports. Traditional exports from Africa are being displaced increasingly by new and relatively efficient products from other regions.

However, in 1996-97 this position began to change. According to the *World Economic and Social Survey, 1997*, African economies experienced a rising GDP per capita, with at least 22 countries reaching a GDP growth rate of 5 percent or higher, and 11 countries reaching a rate of 6 per cent or higher in 1996. Also, inflation has been declining in many countries in the region since 1995. Unfortunately, the global financial crises of 1998-99 produced a global economic slowdown that also affected African economies. Furthermore, even with such impressive growth, even higher rates are required to begin to adequately address the overwhelming poverty and unemployment found in the region.

One of the major repercussions of endemic macro-economic and political instability on the continent has been to worsen the competitive environment for the African private sector. Also, policy and strategy networks for the African private sector are mostly weak an ineffective in influencing the important debates on world trade. These networks will have to be strengthened in order for the African private sector to enhance its competitiveness and place in the world economy.

National and Regional Legal and Regulatory Frameworks

With no real national boundaries, the legal implications of the Internet and the World Wide Web are immense. Thorny issues such as intellectual property protection, privacy, security, data protection, electronic payments and currency, and wide-ranging consumer protection issues have to be addressed in national legislation and regional strategies; each with tremendous social and economic implications. On one hand, appropriate legal and regulatory infrastructure will enhance a country's ability to attract investment and can help to stimulate local participation in the Information Economy. On the other hand, an inappropriate legal and regulatory environment can dis-empower local entrepreneurs and cause international investors to look to other countries.

Africa can not afford wasted efforts. It is critical for Africa to work as collaboratively as possible with a multiplicity of actors at national, regional and global levels. NICI plans, as promoted by the Economic Commission for Africa, can serve as vehicles for integrating the efforts of these disparate actors. Obviously, where possible, these NICI plans should be integrated into sub-regional and regional strategic planning.

4. Opportunities for Africa in the Information Economy

Without a doubt, the challenges facing Africa in the Information Economy are daunting. However, given the fundamental shift in the nature of the global economy, it is critical that strategies for African development be shaped within this reality. There are many new "windows of opportunity" for Africa in the age of Globalization and the Information Economy. The transition of the global economy to one based on knowledge and information presents numerous opportunities for developing countries that are willing to address them strategically. African and other developing countries can move to strategically develop competitive advantages within this new economy, based on their own specific histories and material conditions.

In order for these opportunities to be realised, it is clear that parts of Africa must move quickly to become what Saskia Sassen and Keven Cox call "spaces" of Globalization. To become spaces of Globalization, specific geographic areas must be re-oriented to be able to more fully take advantage of the Information Economy through the development of information infrastructure and knowledge workers in their countries. This re-orientation includes developing a comprehensive strategic vision that harnesses the potential of Globalization and the Information Economy within that geographic space. Of the numerous potential applications emerging from the global Information Economy, some have greater strategic importance for Africa than others, and may have a significant impact on the socio-economic development of our people. Applications of potential strategic importance include the following: (1) content development; (2) electronic commerce and SMMEs (3) education, learning and research; (4) rural development. In each of these areas, very specific opportunities and niche markets exist for Africa and the developing countries. Each of these areas will now be reviewed in turn.

Creating Content: The Strategic Importance of SMMEs

The Information Economy is first and foremost about information. A wide range of new technologies and new techniques engendered by the information revolution allow for the production and distribution of new knowledge and the dissemination of data, information and knowledge. Some of these technologies include the Internet, the World Wide Web, CD-ROM, digital audio, video and other forms of new media.

The Information Economy provides African countries with an historic opportunity to create new information industries and to participate in global strategic partnerships of other information enterprises. Given the richness and diversity of African culture, specific information industries built around strategies to harness these technologies and capitalise on this cultural richness could prove to be quite economically beneficial. Table 3.1 below presents the revenue generated from electronic commerce transactions by sector in South Africa, illustrating the potential for the region.

Table 3.1 South African Web-centric e-Commerce and Sector Penetration, 1999 - 2005

Vertical Sector	**Value of eC Transactions (Rm)**						
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Healthcare	0	0	0	0	0	0	0
Pharmaceuticals	0	0	0	0	0	0	0
Retail buying	76	348	978	2173	6532	15408	31581
Manufacturing and Distribution	174	765	2085	4518	13720	32037	63539
Travel and accommodation ticketing	126	378	1109	2142	5720	9511	15791
Event Ticketing	100	151	181	217	455	628	866
Subtotal EDI-centric categories	**476**	**1641**	**4352**	**9050**	**26426**	**57585**	**111777**
Computer hardware	360	720	1440	2880	4320	6931	7902
Computer software	30	90	270	810	2430	4977	5972
Other electronic equipment	15	45	90	180	360	720	1440
Books, CDs, Music and Video DVDs, etc.	25	63	125	250	375	514	555
Clothing, toys and sporting equipment	1	2	4	7	11	257	278
Information services	84	167	251	376	700	956	1178
New cars	12	30	69	151	302	603	1207
Used cars	34	82	165	329	494	741	1111
Property	1500	1875	2344	2930	3662	4578	5722
Gambling and lotteries	50	150	300	480	768	1229	1966
On-line game playing	6	12	18	23	30	40	51

Electronic products	37	48	132	165	205	260	300
Other products	5	20	40	80	160	320	640
Other services (incl. Professional svcs, education, etc.)	160	240	360	540	810	1215	1823
Sub-total or web-centric categories	**2319**	**3543**	**5606**	**9201**	**14626**	**23340**	**30145**
Total Web-Centric	**2795**	**5184**	**9958**	**18251**	**41053**	**80925**	**141922**
Source: BMI-Tech SA Electronic Commerce Overview, 2000							

One of the most important aspects of the Information Economy is the rise and incredible growth of electronic commerce (e-commerce). E-commerce is transforming the global marketplace, and its impact is being felt in diverse areas such as production, distribution, finance, culture and the reengineering of government. These forms of "business-to-consumer" e-commerce will be perhaps more critical to the developing economies than in the developing world. Very small entrepreneurs, particularly in the cultural industries, will be able to take advantage of global niche markets of much greater size than their local markets.

Through the development of the complex mix of skills required for e-commerce, African entrepreneurs and businesses will better positioned to participate in global value chains for knowledge-based enterprises. These forms of "business-to-business" e-commerce will provide opportunities for competent African businesses to increase their markets as well, far beyond their national borders.

The African private sector, which consists in large part of small, medium, and micro-sized (SMMEs) and the informal sector, is widely regarded as a possible engine of growth in the Information Economy (see Cogburn and Adeya, Forthcoming). SMMEs usually have a tremendous flexibility and are able to produce new products quite quickly. SMMEs can broaden their markets through co-operative arrangements that disseminate information on local or regional products and services. The success of these efforts depends on the ability of locally based trade and professional associations, chambers of commerce and grass roots organisations to develop demand-driven mechanisms for delivering these services. Potential opportunities within the Information Economy include the formation of strategic alliances with strong foreign distributors as a way of accessing new markets, while at the same time improving the quality of their products. Table 3.2 below, illustrates the distribution of SMMEs in South Africa relative to large companies.

Table 3.2

Distribution of Private Sector Enterprises in South Africa, 1998

Province	**Survivalist**	**Micro I 0 Employees**	**Micro II 1-4 Employees**	**Very Small 5-20 Employees**	**Small 21-50 Employees**	**Medium 51-100 Employees**	**Large 100+ Employees**	**Total**
Eastern Cape	25,600	24,700	17,900	12,100	3,700	612	360	84,900
	14%	9%	10%	7%	6%	5%	6%	9%
Free State	10,900	11,600	10,800	9,900	3,200	472	248	47,200

	6%	4%	6%	6%	5%	4%	4%	5%
Gauteng	44,200	102,000	53,200	75,400	26,000	5,197	2,817	308,800
	24%	36%	29%	42%	44%	46%	47%	34%
KwaZulu Natal	40,900	50,000	37,000	27,800	9,400	1,965	998	168,100
	22%	18%	20%	15%	16%	17%	17%	19%
Mpumalanga	14,600	15,000	9,600	8,500	2,800	508	286	51,300
	8%	5%	5%	5%	5%	4%	5%	6%
Northern Cape	2,600	4,100	6,600	3,800	1,100	160	67	18,300
	1%	1%	4%	2%	2%	1%	1%	2%
Northern Province	14,300	16,000	8,600	5,600	2,000	409	194	47,100
	8%	6%	5%	3%	3%	4%	3%	5%
North West	14,300	17,300	10,600	8,000	2,700	391	185	53,300
	8%	6%	6%	4%	5%	3%	3%	6%
Western Cape	17,300	42,700	28,500	28,900	7,900	1,608	862	127,800
	9%	15%	16%	16%	13%	14%	14%	14%
Total	184,400	283,300	182,800	180,000	58,900	11,322	6,017	906,700
	100%	100%	100%	100%	100%	100%	100%	100%

Source: Ntsika, *State of Small Business in South Africa, 1998 Review* (1999).

Given the increasing Globalization and restructuring in the world's social, political and economic systems, the requirements for knowledge, education and learning have changed dramatically. A new educational paradigm for the information age is required (in terms of structure, function, curriculum, and approach) at all levels.

In the age of Globalization and an Information Economy, the objective of education is no longer simply to convey a recognised body of knowledge, but to enhance the ability of each learner to generate, access, assess, adopt, and apply knowledge and information to complex problems. Information age learners should not be presented with "ready-made" problems, but should be required to make major contributions to problem identification. A new educational paradigm should teach students how to think critically and independently, exercise appropriate judgement; collaborate with others; adapt to new and uncertain situations; identify problems and then solve them; and to synthesise old information with new (see Cogburn 1998).

These educational requirements for the Information Economy workforce are critical. However, the systems developed for informal learning, specifically for adult learners to engage in life-long learning, are equally important. Using new information and communications technologies, there is the potential for expansion of educational opportunities through the use of technology-enhanced learning and other distance learning techniques. These approaches increase the learning opportunities for students, and are suitable for widely scattered student bodies common in Africa. In many African countries, students are already benefiting from online courses and technology-enhanced learning approaches.

One example of the potential of these new technologies to support human capacity development has been explored in a creative partnership between the University of Michigan School of Information and the University of the Witwatersrand, Graduate School of Public and Development Management and their Learning, Information, Networks and Knowledge (LINK) Center. It is called the *Global Graduate Seminar on Globalization and the Information Society: Information Systems and International Communications Policy*. This experiment uses commercially available off-the-shelf web technologies to create a geographically-distributed learning community between four universities, to in the United States, and two in South Africa (Atkins, Cogburn, et al, 2000). This experiment has been completed successfully for the past two years, and has now expanded into a Collaboratory for Technology-Enhanced Learning Communities (CoTelCo), involving several universities, and spin-off activities.

Many academic libraries have stopped their subscriptions to international journals due to budgetary constraints. Some of these journals are very expensive and only one or two articles may be relevant to the users. Considering that access to academic journals has become a stumbling block for many scholars in Africa, there is great potential for digital libraries and electronic publishing. For instance, if the table of contents and abstracts are provided freely then subscribers/buyers can pay for specific full-text copies. Libraries can therefore subscribe on behalf of clients at a lower fee than full-text traditional print journals.

Rural Development

Given that the majority of people in African countries live in rural areas, any attempt to meet the challenges of Globalization and the information age must include rural development strategies. By setting up access points to Its in rural locations, information on micro finance, marketing, practical tips on business formation, agricultural expertise, health and sanitation knowledge-based development, can be disseminated at low cost. These centres can serve as incubators for the development of SMMEs and help to stem the tide of migration from rural to urban areas (and the concomitant overcrowding and other socio-economic problems) that plagues nearly every major city in Africa.

There are many new and exciting opportunities for Africa in the Information Age. However, in order for Africa to reap the benefits discussed above, strategic planning and collaborative approaches are required at national, sub-region, regional and global levels. This final section presents recommendations that should enhance Africa's ability to confront the challenges of Globalization and the Information Economy.

5. Recommendations and A Way Forward

During one of the preparatory meetings for the ADF'99, Professor Clement Dzidonu of the International Institute for Information Technology (INIIT) in Ghana asked the Technical Advisory Committee an important question: "What must Africa do to move from its current orientation towards PACE (Predominately Agricultural and Commodity Economies) to PIKE (Predominately Information and Knowledge Economies) orientation?" As a partial response to this question, this penultimate section presents some recommendations and a way forward for the region. It argues that the best approach to meeting the challenges to Africa of Globalization and the Information Economy is strategic planning and implementation that involves public, private and voluntary sector participation and partnerships, at national, sub-regional, regional and global levels.

National Planning and Implementation

Strategic planning and implementation to confront these challenges has to begin at the national levels. There are critical roles for every societal actor to play in this process. Leaving key stakeholders out of this process will hinder the development of an effective vision and national plan that will meet the needs and objectives of all relevant parties.

The African Information Society Initiative (AISI) advocates the creation of National Information and Communications Infrastructure (NICI) plans, and many countries in the region have initiated such a process. In most countries, the NICI plans are being designed to work in conjunction with regional and global frameworks, such as the AISI. These NICI plans can also enhance educational initiatives, giving them the national imperative needed, and work to create an enabling environment for the private sector. It is important for these NICI plans to provide support for existing sub-regional, regional and global partnerships and collaborative frameworks (e.g. AISI and PICTA). In addition, the NICI plans should include the active involvement of the private sector in creating a predictable, market-driven legal and regulatory framework to facilitate global electronic commerce. Some of the issues that this framework should address are as follows:

- Customs and Taxation
- Global Uniform Commercial Code
- Privacy and Consumer Protection;
- Security and Encryption;
- Content Development and Regulation;
- Technical Standards and Interoperability;
- Education and Employment;
- Electronic Payment Systems and Financial Institutions; and
- Intellectual Property Protection.

Governments must provide an enabling environment to foster the growth of technology and technology related industries in the economies of Africa. It is clear that there is no "one-size-fits-all" solution to the problems facing African countries. National policy formulation must be specifically tailored to meet clearly defined national objectives, based upon local realities, constraints and needs. However there are some identifiable common principles, and African decision-makers should actively pursue the vigorous debate around these principles at all levels.

Access to information and communications technologies is critical for effective participation in the global Information Economy. Government policy should focus on reducing the cost of information technology to the end user as rapidly as possible. Import duties and sales tax should be immediately removed from computer hardware and software (this is already the case in some countries, e.g. Mauritius). Special corporate and personal income tax deductions should be introduced to allow individuals and companies to offset the purchase of computer equipment against earnings, at perhaps two times the purchase price. Soft loans should also be made available to individuals to purchase computer equipment. Governments can also fuel demand for Its by being a visible user of the technology. This can lead to increased government efficiency and have a powerful demonstration effect to those reluctant to invest in the requisite infrastructure. Further, liberalization and privatization in the telecommunications industry in Africa should be accomplished as rapidly as possible. Liberalization and privatization are not the end goals, but are the means to achieve the lowest possible prices, most advanced services, and network expansion to meet universal access objectives.

African governments should focus on their education policies. The promotion of science and technology is a cornerstone of the kind of economic progress that Africa needs if it is to compete in the twenty-first century. From the information industry to the biotechnology field, scientific innovation is the driving force of growth and development. Africa's share in the world's scientific output fell from 0.5% to 0.3% between 1985-1995; Africa as a whole counts only 0.36% scientists of the world total, while African scholars continually contribute to scientific development through brain drain. African countries should pool expertise in regional centres of excellence and where economies of scale permit, pursue regional strategies. A regional centre could also be promoted in the field of R&D into design of appropriate technologies for Africa.

Governments can upgrade national technological capabilities by the establishment of information-intensive institutions that can provide extensive extension services on a wide scale and deliver comprehensive packages of assistance comprising technical know-how, finance, management skills, training and sales information. Any efforts to prepare the continent for an era of accelerated structural change must encompass policies to address basic needs and ensure an environment that is conducive to creating the necessary conditions for the Information Economy.

Sub-Regional Co-operation

Many of the sub-regional economic and political groupings have started developing strategic plans for aspects of the Information Economy. These sub-regional strategies are critical as the first line of regional and global collaboration. Countries should pursue active, high-level participation in these sub-regional processes. In addition, these sub-regional institutions should quickly develop clear mechanisms for substantive and representative private sector and civil society participation in these strategic planning processes.

Regional Co-ordination

At the regional level, the leading initiative is the African Information Society Initiative (AISI) being co-ordinated by the ECA. The AISI was adopted in 1996 by all 53 African ministers of social, economic development and planning, and endorsed by the African ministers of communications meeting in Abidjan, Cote d'Ivoire to develop the *African Green Paper on Telecommunications*. It was launched publicly at the G7/Developing World *Information Society and Development Conference (ISAD)*. The AISI outlines key roles for national governments, as well as for civil society, media and the private sector. Implementation of the AISI is supported by a consortium of donor and executing agencies working together in an informal network called the Partnership for ICTs in Africa.

Also at the regional level, the *African Connection* is an initiative of the South African Department of Communications, supported by many African ministers of communications and the World Bank. The *African Connection* aims to promote a more rapid development of the information and communications infrastructure necessary for Africa's entry into the Information Age. The African Connection is partnering with ICO Global Communications and the Global Information Infrastructure Commission (GIIC) in an Info*Dev* sponsored programme to develop a regional regulatory policy for GMPCS.

Finally, the GIIC has launched GIIC Africa, a regional initiative developed to support the African private sector active in the knowledge and information industries. During the ADF, GIIC Africa is co-ordinating the private sector focus group and as part of the follow-up mechanisms for ADF is forming the Alliance for African Business (AAB) as a broad informal umbrella coalition of private sector organizations and interest groups from the region and around the world.

A key objective of these regional initiatives should be to develop regional strategic policy responses to the numerous issues that are emerging in the governance of the global Information Economy. These issues include Internet governance and the International Corporation for Assigned Names and Numbers (ICANN), and the World Trade Organization (WTO) negotiations and electronic commerce developments.

Global Collaboration

At a global level, some of the most important strategic responses are emerging from the Global Knowledge Partnership (GKP) facilitated by the World Bank, and the Alliance for Global Business (AGB) facilitated by the GIIC.

The Global Knowledge Partnership is an evolving, informal partnership of organizations--public, private and not-for-profit--committed to sharing information, experiences and resources to promote broad access to, and effective use of, knowledge and information as tools of sustainable, equitable development. It emerged from the co-operation of several dozen organizations in sponsoring the Global Knowledge 97 conference, "Knowledge for Development in the Information Age" in Toronto, Canada in June 1997.

The Alliance for Global Business (AGB) is a co-ordinating mechanism of leading international trade associations created to provide business leadership on Information Society issues and electronic commerce. Jointly, these organizations represent the bulk of electronic commerce in almost all countries in the world. The coalition represents a diverse cross section of business in over 140 countries. Membership includes providers and users of information technology, large multinational enterprises and small start-ups, and companies in developing as well as developed economies. The AGB was created in response to the need for a coherent and unified, global industry voice to international organizations and governments around the world. The Alliance represents a broad range of industry with a focus on high-tech manufacturers, service providers and information technology users from nearly every sector of the global economy.

Also, the WTO is engaged in a "Work Program" on electronic commerce that has particular relevance to developing countries, and the OECD research program on the Information Economy and Electronic Commerce are critical to developing the intellectual base for understanding this period.

6. Conclusions

As continue our first steps into a new millennium we are witnessing an historical period of Globalization and the emergence of a new

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global Information Economy that is underpinned by revolutionary changes in science and technology. Technological innovation in such diverse domains as ICT, transportation, material science (alloys, ceramics, fibre optics, composites) and biotechnology are fundamentally re-wiring the global economy. Underpinning all these advances are a host of ICTs that are helping to unleash the potential of other technologies and creating revolutions in other areas. In this new global economic environment, information and the knowledge it provides has become a key factor in economic competitiveness.

This paper has focused on the implications for Africa of Globalization and the emergence of the Information Economy - going beyond the hype to explore the challenges that it poses and the promise that it holds. It has argued that whether African countries benefit or lose out from the structural shift to an Information Economy is predicated on the existence of a host of competencies ranging from designing and implementing information infrastructure, to the creation by governments of a legal and regulatory environment that promotes entrepreneurial activity and private-public partnerships, to creatively exploring mechanisms to enhance strategic human resource development.

The first conclusion of this paper is that Globalization is a reality. Although it is a misunderstood, contested, and possibly over-hyped term, there are unique elements to this historical period. The information revolution is leading to the development of an Information Economy and Information Society. With the emergence of the Information Society, numerous additional challenges emerge. Many nations are working to address these challenges, both in collaboration with other countries and international organizations, as well as independently. It is also important to note that there is a substantial amount of activity in the building the Information Society in Africa.

A second, and somewhat obvious, conclusion is that the “digital divide” continues to exist, and is in fact widening, between the developed and developing countries, in terms of their ability to harness the potential benefits of Globalization and the Information Economy. There is also a growing gap within countries between their digital elite and the mass numbers of the unconnected. These gaps are reflected in both the "hard" and "soft" infrastructure statistics. This gap will affect the ability for the developing countries to be able to take advantage of these opportunities. In order to address these issues, it is critical for development initiatives to address the science and technology capabilities of African countries. However, there are new and innovative approaches that may begin to close this infrastructure gap.

One innovative approach might be multi-purposes, community information centres (MPCICs). These facilities can serve as shared infrastructure for a wide-variety of Information Society applications. The business models for these centres range from fully-owned public sector centres operated on a "utility" model, to fully-owned private sector centres operated by African entrepreneurs.

Finally, one of the conclusions of this paper is that the African private sector must pursue a more active voice in the formulation of public policy and national strategies to promote the Information Society.

Globalization and the Information Economy presents African countries with an array of opportunities for increasing economic development in such areas as the creation of new industries, rural development and tourism promotion. Countries that do not facilitate this information revolution will likely fall further behind, both relative to the rest of the world and relative to other countries in the African continent. Countries that confront these challenges through strategic planning and public/private partnerships can reap huge benefits in terms of economic growth and socio-economic development.

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Back to top of page **Back to the sessions page**

Derrick L. Cogburn

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Derrick L. Cogburn is an Assistant Professor of Information at the University of Michigan School of Information and an Assistant Professor of African Studies at the Center for Afroamerican and African Studies at the University of Michigan.

Dr. Cogburn's research program focuses on the area of international regime transformation in response to globalization and the emergence of an information economy and society. Included in this research program are issues of global electronic commerce; Small, Medium, and Micro-Sized Enterprises (SMMEs); Multi-Purpose Community Information Centers (MPCICs); and Computer Supported Collaborative Learning (CSCL). At the School of Information, he teaches within the Information Economics, Management and Policy specialization, and contributes to the Alliance for Community Technology (ACT), the Collaboratory for Research on Electronic Work (CREW) and the Program for Research on the Information Economy (PRIE).

The United Nations has appointed Dr. Cogburn to several committees, including the High-Level Working Group on Information and Communications Technologies in Africa (which developed the *African Information Society Initiative - AISI)*, the Committee on Development Information, and the Technical Advisory Committee of the African Development Forum. He is an active member of the Partnership for ICTs in Africa, and served for two years as a member of the G8 Government On-Line steering committee.

As an adjunct fellow at the Center for Strategic & International Studies in Washington, D.C., Dr. Cogburn helped to found the Global Information Infrastructure Commission (GIIC) and launched its first regional organization, GIIC Africa. Dr. Cogburn has served in a number of policy advisory roles for the South African government. He is currently completing a book, *Globalization, the Information Economy and State Autonomy: Information Society Regime Formation and Telecommunication Sector Restructuring in South Africa*. His doctorate is from Howard University where he served for two years as a W.K. Kellogg Doctoral Fellow with the Ralph J. Bunche International Affairs Center.

Back to proceeding page **Back to the sessions page**

Program

Social / Cultural

Monday, 15 January 2001
1400–1530

M.2.1 Reducing Global Telecommunications Problems

Location: Tapa III

Chair:

ROBERT WALP, Vice Chairman, GCI, *USA*

Speakers and discussants will address the need for change in non-governmental and inter-governmental non-profit telecommunication organizations to meet the rapid changes in the telecommunication industry. Issues of membership, finances, use of technology in member services, and relevance to business will be discussed. Special attention will be given to the need to address deep-rooted, long-term global problems prior to their emergence as major crises.

New Bottles for New Wine: Non-Profit Organizations Meet Challenges of a Changing Telecommunication World (*ABSTRACT*)

RICHARD BARBER, Adjunct Fellow, East-West Center, *USA*

Describing and Reducing Global Telecommunications Problems (*ABSTRACT*)

DAN J. WEDEMEYER, School of Communication, University of Hawaii, *USA*; RYOTA ONO, Associate Professor, Department of Business Administration, Aichi University, *Japan*; JENIFER WINTER, Ph.D. Candidate, Communication and Information Sciences, University of Hawaii, *USA*

Needs for and Benefits of a Private Telecommunication Operating Foundation (*ABSTRACT*)

GEORGE J. LISSANDRELLO, Information Products International, USA and ZOILO JESUS M. DELA CRUZ III, President & CEO, Infoserve, Inc., *Philippines*

New Bottles for New Wine: Non-Profit Organizations Meet Challenges of a Changing Telecommunication World

Richard J. Barber

Abstract

http://www.telefoundation.org/biobarber.htm

Introduction

This paper examines the changing roles of non-profit organizations active in the international or regional telecommunication/information technology arena. Beginning with a synopsis of the changing requirements for information technology in meeting member or client needs will be noted. Likewise attention will be given to the use of new telecommunication technology in the conduct of the affairs of the non-profit organization. Differing types of non-profit entities will be discussed, looking at the roles they play. Speculation regarding the future of non-profit organizations will conclude the paper.

Global Telecommunication Landscape

The new international information infrastructure, a current telecommunication landscape, the establishment of new organizations and the changes made in existing groups to meet the altered requirements of the industry will be discussed. The convergence of digital technology and globalism, is changing the way we conduct business, entertain, educate, interact socially, and provide for our well being. The benefits of the information technology are many and varied. At the same time there are a number of concerns.

One concern heard frequently is the lack of access or affordability or ability to use information services and systems. Looking back not too far the gap between those with and those without basic telephony service was dramatically spelled out in the 1984 Maitland Commission report of the International Telecommunication Union. As late as 1994 sir Donald Maitland, speaking at PTC'94 in Honolulu voiced the concern that it was regrettable that the gap had narrowed very little in many parts of the world. At that same meeting, ITU Secretary General, Pekka Tarjanne voiced the fear that another gap would emerge - what we now call the "digital divide", the access to broadband services.

A current assessment shows that significant parts of the globe continue to lack sufficient basic telephony service, and by an extension are on the far side of the digital divide. Much of Africa and South Asia and parts of Latin America and South East Asia are in this category. In contrast, rapid development has or is being evidenced in much of Asia and Latin America.

On a global scale it is evident that the industrialized countries have used their well- developed telephone and electrical power systems as a platform upon which to build vast networks able to handle the growing data, video and Internet traffic.

At the same time that the digital gap grows between countries and global regions, a similar domestic digital divide is cause for concern within countries. Even in the more advanced countries we hear the cry to place computers in the classrooms, mainly as a way of insuring a certain equity between people and perhaps to insure an adequate labor supply in the future. Indeed the availability and movement of trained people is a major source of controversy between countries as well as between labor short high tech firms within countries.

A number of assumptions appear to be in play which affect our stance towards the question of access.

a. We assume that the inclusion of greater numbers of individuals having access to telephony and the Internet will have a positive impact on the global economic system. That is, the Internet is good for competitive businesses and consumption.

b. We assume that the basic "unit" of the new IP world is the individual human being.

c. We assume we cannot afford IP access to everyone in the developing world.

In the Maitland report, a goal was set to have a telephone within a day's walking distance for all persons. While this goal is still to be realized in certain regions, we are now talking about access to Internet facilities. Does this create a new un-reachable goal? Or, are lofty goals necessary to stimulate action above that of business as usual/

With the new technology afforded by satellites it is within reason to place Internet capable terminals in most of the villages of the world. Using VSAT technology available off the shelf, and accessing the proper satellite links, one can provide services anywhere. Roadblocks include finance - hardware, software, human resources all cost money. In some cases, regulations block access. Concerns over privacy and national boundaries cannot be ignored.

If we look at the miles of terrestrial and under seas fiber optic cables already installed and the pace of additional facilities underway, coupled with the continuing progress in the transmission technology, the globe is truly becoming "wired". Add to that the ongoing development of high-powered satellites and the rapid advent of wireless technology, we are truly faced with a "new world." But when we say "we", do we really think of the true "we"? Can we continue as a world divided by digits, or more accurately, perhaps, as a world divided by those who consume lots of goods and services and those who are on the other side of the consumption gap?

Such concerns are addressed, in part, by non-profit organizations classified as Non-Governmental (NGO), Inter-Governmental (IGO), foundations and associations. New entities are being formed on a continuing basis and existing organizations are in constant state of revision.

New Institutions

It appears likely that several disruptive things will happen in the foreseeable future, which could be tempered given a reasoned, long-term look at the elements.

a. The digital gap between countries and between segments of society within countries will Balkanize areas of the world thereby increasing the barriers to commerce and development.

b. The impact of the Internet on its users will be unintended, but significant (some directions are evident today such as the Web's anti-social sites, fraud, cultural erosion.

c. Major portions of the Internet system will have a major crash bringing commerce to a standstill.

As it appears unlikely that for-profit organizations are able to take the long term perspective nor the imagination needed to address such issues on a global scale, we turn to the non-profit entities. Non-profit organizations may or may not be able to alleviate such concerns. Nonetheless, as we can learn from history, such entities rise to the challenge and quite often go on to serve in a number of capacities.

Telecommunication is no stranger to new structures. In 1865 the International Telegraph Union, later the International Telecommunication Union (ITU), was created partly to facilitate the trans-border flow of telegraph messages. This was done through the adoption by member countries of a common standard for telegraph messages across national boundaries, alleviating the need to re-key messages going in either direction. As technology advanced so did the work of the ITU in providing an intergovernmental forum for the development and adoption of standards, the allocation of radio frequencies and later the coordination of orbit slots for communication satellites.

Like the advent of the telegraph, the advent of the communication satellite fostered new cooperative, non-profit entities. What could have become a commercial, competitive undertaking became an international treaty organization, INTELSAT, which provided global communication services at standardized rates, allowing all member countries reasonable international and domestic satellite capacity. The United States' government created COMSAT to serve as the US member to INTELSAT, again demonstrating the need for creativity.

Using the New Technology

As we consider the creation of new organizations to meet the growing need to intelligently manage the new economy, the new technology; or as we move to alter existing organizations, we should also consider how we can creatively use the new technology to manage the affairs of these entities.

The American Society of Association Executives (ASAE) through its monthly magazine and in seminars and working groups has been tracking the rapid up take of the Internet in the governance and administration of non-profit organizations. Through informal contacts with dozens of international non-profits, IGOs and NGOs, it is easy to conclude that nearly all such organizations use the Internet in one way or another. Trough the web organizations typically offer a home page, overview, information about their activities, press releases, the structure of the organization, a list of contact information for key people, links to other organizations, and sources of additional information.

In spite of the rapid move to electronic information systems, print material still abounds. Rather than go all the way to electronic formats, most organizations continue to produce printed reports, conference proceedings, newsletters, etc. The shift away from hard copy to electronic format is tempered by several factors including the need to reach members or clients who are not able to access the more advanced modes of communication.

Organizations which are concerned with the telecommunications and information technology field are especially pressured to utilize the new technology in serving their client bases and equally to use such technology in their internal conduct of business. In the case of many internationally based groups, the range of client or member ability to make use of the new technology varies considerably. The causes also vary from a lack of infrastructure, lack of skills, lack of volition, inability to afford connectivity, or lack of conviction that new is better. Usually one finds a combination of reasons.

The approach by several international IGOs and NGOs is to provide communication in alternative modes and to adjust to changing client capabilities and demands. The experience of PTC illustrated that over time more and more members migrated from the old to the new technology. This was true for the shift from Telex, which was for years the primary mode of global text communication, to Fax, and now from Fax to e-mail. The use of voice communication including audio conferencing has grown as well, reflecting in part the reduced tariffs available in many parts of the globe. Hard copy via domestic and international post and private delivery firms is still prevalent.

The challenge to the non-profit organization is clear. It must understand its client base's ability to communicate via a number of differing modes and it must be able to shape its messages accordingly. The first steps, of course, are to become communication proficient in management and governance related tasks. Professional organizations such as the ASAE provide guidance in this area. In the United States, NetCorps responds to requests from non-profit entities for assistance in coping with computers and the Internet (www.netcorps.org).

Multiple Roles Played by Non-Profits

Non-Profit entities in the telecommunication/information technology field play a number of roles. While there are overlapping concerns and conflicting activities, we can usefully categorize most organizations along several lines.

Some non-profits focus on the individual, providing professional development, self improvement, career enhancement, certification, employment seeking assistance and general networking. Such organizations may also provide for the enhancement of the profession itself. The International Electrical and Electronics Engineers (IEEE) is the premier such body with global membership, country counterparts, several categories, and well respected conferences and training activities.

The Society of Satellite Professionals International (SSPI) also focuses on education and training for the enhancement of satellite related employment and professionalism. SSPI's members come from around the world, but are heavily weighted to North America. It operates in part through regional chapters. In a recent newsletter the SSPI president Maury Mechanick stated " the ability to adapt to change is always 1 of the greatest challenges facing a volunteer professional organization such as SSPI." Key guideposts noted were "maintaining membership value, coping with financial security, and prioritizing to maintain realistic focus."

Many other non-profits are concerned with professional development as a segment of their overall mission and objectives.

A key role in our arena is the allocation or management of scarce international resources. In this category we find mainly intergovernmental organizations. We have earlier mentioned the ITU, the oldest member of the United Nations family. It is made up of country members and non-voting affiliate members from the private sector. Among the resources under the management of the ITU is the allocation of radio frequencies, the coordination of the allocation of orbit slots for communication satellites, many of the standards for telecommunication applications, and the provision for telecommunication development assistance. The latter often done in conjunction with other UN agencies, especially the United Nations Development Program.

The ITU conducts a series of regional conferences and a major forum and exhibition every four years. The ITU recently completed a re-structuring which was aimed at making the organization more efficient and more responsive to the rapid changes in the telecommunication technology, systems and services.

Several regional IGOs are worth noting. The first two are related directly to the ITU as regional sounding boards and as regional telecommunication training and network development bodies. CITEL (Conference on Inter-American Telecommunications) is the telecommunication sector of the Organization of American States. It operates through a set of study groups, workshops and conferences addressing topics of concern to the ITU and to the region. A parallel organization covering the ESCAP region is the Asia-Pacific Telecommunity (APT), based in Bangkok. Like the ITU the APT is governed by member states but also has associate or affiliate members. Like CITEL, APT addresses regional issues of interest to the ITU.

The South Pacific Forum, an inter-governmental body representing the independent nations of the north and south Pacific had long played an active role in fostering the development of telecommunications in the Pacific region. For various reasonsIn 1997 the telecommunication entities in the Pacific Island area inaugurated a new organization, the Pacific Island Telecommunications Association (PITA) with headquarters in Suva, Fiji. This body grew out of the actions by the South Pacific Forum when that intergovernmental organization disbanded their long standing Forum Telecommunications Program. PITA serves as a focal point for both private sector and governmental telecoms organizations in the island area. PITA members maintain that their circumstances are unique and require the special attention made possible through their regional association.

Continuing in the realm of the IGOs, one of the more active organizations in the Asia Pacific Region is the telecommunication working group of the Asis Pacific Economic Cooperation (APEC), usually referred to as APEC-TEL. As a part of the overall APEC body, the telecommunication group has been quite active under the direction of a series of effective leaders from the US, Canada and Singapore. APEC-TEL directs a number of task groups, and working with input from the private sector, develops policy proposals for consideration for the higher level ministerial members of APEC.

One of the primary non-governmental organizations having input to the APEC-TEL process is the Pacific Economic Cooperation Council (PECC) which has a task force on telecommunication and is a guest member of APEC. PECC, founded in 1980 initially mounted a major project titled "triple T" examining the economic relationships between transport, telecommunication and travel. PECC now works closely with APEC, providing information and policy advice from their private sector members. It should be noted that the governmental delegations to APEC include individuals from the private sector as well.

The roles played by industry-focused organizations can be illustrated by the several satellite oriented organizations which have been created to meet the rapid growth and importance of this sector of telecommunication. The Asia-Pacific Satellite Communications Council (APSCC) was founded in 1994 in Seoul, Korea as a "semi- government regional cooperative body whose aim is to promote satellite communications in the Asia-Pacific region where the service demand is growing rapidly." It vows to "maintain cooperative relationships with other organizations in the region such as PTC and APT. APSCC will leave its door wide open for active participation by persons or organizations interested in satellite communications." Here, the exact classification is difficult as the organization appears to be in part at least a creature of the government of Korea.

The Global Vsat Forum is made up of companies and individuals engaged in the provision and use of small terminal satellite dishes. Given the strides made in the use of satellite for broadband communication, this organization is experiencing continued growth and attention.

A third satellite oriented non-profit , the Society of Satellite Professionals International, was noted earlier.

Another significant regional organization whose status is primarily non-governmental is the Asia-Pacific Broadcast Union (ABU) headquartered in Kuala Lumpur, having been founded in Tokyo in 1964. The ABU has more than 42 full members in 30 countries as well as a number of Associate members. The ABU's mission is to foster the use of broadcast media as a means to further national development in the Asia-Pacific region. It works closely with the Asia-Pacific Institute for Broadcasting Development (AIBD) which is co-located with the ABU. Its aim is to foster the development of professionals in the broadcast profession.

Many of the organizations discussed so far have resources to manage or are able to play a direct role in allocation of goods and services, thus operating from a solid support base. Others, such as membership associations and loosely organized groups must depend on somewhat intangible "services" or activities. The International Institute of Communication (IIC) and the Pacific Telecommunications Council (PTC) illustrate this category quite well. They both rely upon their provision of contacts or networks linking people engaged in relevant activities or having useful information. Much of the value of these "general" organizations is their ability to attract to the network individuals from competitive organizations; people having differing viewpoints; people from different cultures; and individuals with complimentary ideas.

The PTC was begun in 1979 at a conference in Honolulu, Hawaii. Officially incorporated in 1980, the PTC now has more than 600 members from around the globe with concentrations in North America and East Asia. It produces the most significant annual gathering of individuals covering a wide scope of interests each January in Hawaii. In past years the PTC has sought to interact with other non-profit organizations in the region, creating an informal grouping dubbed the Federation of Regional Associations (FORA). Some ten or twelve leaders of such organizations met twice annually, usually in Singapore in conjunction with CommunicAsia in the summer and Hawaii in the winter in conjunction with the annual PTC conference.

Also in the late 1970s, the IIC was established, initially as the International Broadcast Institute (IBI). While PTC is more Asia-Pacific-Americas oriented, the IIC is more Europe, Africa, North America focused. Their membership structure is similar but the IIC is more broadcast and social issues oriented with PTC being more telecommunication technology, regulatory, applications orientated. They both hold annual conferences, publish a journal, are involved in research activities, have country chapters and face similar difficulties including those related to membership retention.

Also, in a similar way that PTC approached the need to provide interaction with non-profits in the Asia-Pacific-Americas region, the IIC has been hosting a meeting of a group of foundations for the past several years. Included are communications oriented foundations from Europe, the US and Japan. In their recent meetings in Kuala Lumpur and Tampa Bay, Florida, the discussion centered on the need to focus more on the "Digital Divide." It would seem there is room for cooperation between the foundations and the other non-profit organizations.

Summary and conclusions

We have had a quick glance at the world of non-profit telecommunication organizations against a backdrop of a rapidly changing information technology landscape. The changes we are undergoing are not evenly spread nor are we well prepared for such change. IGOs and NGOs alike are striving to survive and at the same time adapt to new demands and competition from new organizations.

One could argue that the advent of the Internet decreases the need for non-profit organizations in that people are increasingly able to form networks and to cooperatively manage resources. The use of the Internet in business and in informal interactions has certainly challenged the non-profits to remain relevant to their clients and members. Successful non-profits will be those which adapt and apply the new information technology to both their internal and external activities. Smart organizations will use the Internet to build upon existing strengths and resources such as member lists, data banks, publications, and established meetings and events.

At the same time the needs of members who do not have access must be addressed. Lastly, organizations, including relevant foundations, should work toward assisting one-another by sharing information, allowing access to members and collaborating on projects and meetings. As a starting point organizations could coordinate their calendars of events some two years in advance in order to alleviate the chance of overlapping similar types of meetings.

Properly structured and governed the independent non-governmental organization can address telecommunication requirement for more, accurate and relevant information and at the same time offer the ability to members of access to all other members. The Internet makes this possible. Such organizations also have the luxury of being able to explore and think quite far ahead as they are not tied to quarterly or even annual results. The governmental and industry sectors need the long term perspective which can be developed and communicated by the non-profit organization.

Back to top of page **Back to the sessions page**

Richard J. Barber

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Since its inception in 1980 and until his retirement in 1999, Mr. Barber served as Executive Director of the Pacific Telecommunications Council (PTC). For this Honolulu-based non-profit organization, he built the membership to 650 and coordinated twenty international conferences. He also coordinated yearly telecommunications seminars in many cities in the Pacific Hemisphere including Sydney, Seoul, Taipei, Panama City, Suva, Tokyo, Washington, DC, Manila, Wellington, Mexico City, Hong Kong and elsewhere.

From 1970 to 1980, he served as Assistant Director of the Social Science Research Institute at the University of Hawaii, including five years as the Director of the Hawaii Research Center for Futures Studies. He also worked for three years as Conference Director at the East-West Center. He founded FORA, the Federation of Regional Associations. At present, he is an Affiliate of the Stockholm-based FutureComFactory.

In addition to his continuing activities in PTC, Mr. Barber is a member of the Hawaii Tele-Communications Association, the Society of Satellite Professionals International, the International Institute of Communication, the American Society of Association Executives and several other telecommunication associations. He is a member of Phi Beta Kappa.

Go to proceeding page **Back to the sessions page**

Describing and Reducing Global Telecommunications Problems

Dan J. Wedemeyer, Ryota Ono, and Jenifer Winter

Abstract

1.0 Introduction

New and changing telecommunication and information capabilities impact everything we are and will do on this planet, now, and in the future. On shorter and shorter timeframes we are creating capabilities and solutions (or patch solutions) to an increasing number of problems. In turn, apparent solutions to primary and secondary telecommunication problems are adding layer upon layer of complexities to an already complex networked communication environment. This cycle creates an even more difficult, even amplified, set of communication problems, some obvious and reducible, some not so obvious, slowly emerging and "fuzzy" in nature. One assumption of this paper, and one set forth by Bloom (2000) in the last chapter of his recent book, is that the future of human communication promises to evolve into a very much more complex and tightly integrated environment. While it may not be comfortable, or appear cost-effective in the short term, the cost of overlooking or ignoring slowly emerging problems, on a local or global basis, could be unacceptable. Describing and reducing global telecommunication problems requires new approaches, actions and institutions.

2.0 Expanding Timeframes, Methodologies, Theories and Participation

2.1 Expanding Timeframes

Accelerated processes of technological innovation and institutional change have created a world where immediate concerns are taking precedence over long-term concerns. Politicians require re-election in two-, four- or six-year intervals. Business leaders are concerned with quarterly and annual profits, as immediate return on investment (ROI) reigns in the financial world. Academics are required to work on short-term "publishable" projects or risk dismissal. The timeframe for technical research and development is "collapsing". In most domains, so-called long-term strategic plans of more than three years are rare. The "future" is compressing at a time when expanded timeframes are necessary to anticipate and address problems. While it is tempting to focus on current problems with established definitions, it is often the areas about which we are most uncertain and have the least confidence in our ability to anticipate that are the most important and valuable for us to examine (Renfro, 1993). We may not be able to form a complete solution to such a problem; but even a slight reduction in uncertainty provides a significant opportunity for "anticipatory action". So, there are increasing needs to expand our "alternative futures" or "parallel futures" thinking. Anticipating problems in the midrange future (five to thirty years) may be difficult in a complex and rapidly changing global environment, but it is necessary "to avoid the pitfalls of adverse contingencies" (Helmer, 1999).

2.2 New Methodologies/Methods

Expanding timeframes of "anticipatory" research requires the invention of new or expansion of existing methodologies/methods. Most certainly the advancing "world brain", made possible by the Internet, promises new capabilities. Substantial multi-method research and development in "networked forecasting" needs pursuing. Such new capabilities would expand the participant expert base and perspectives, and offer new means for structuring group communication.

One area for development is the implementation of a global monitoring system involving environmental

scanning, a technique that seeks to identify early indications of future developments likely to be important to decision-makers (Renfro, 1993). Increasing complexity and growing uncertainty about the future have made scanning both more difficult and more essential. Scanning is inherently an "imperfect activity", as each individual views the world through a framework that is deeply influenced by factors such as language, professional or disciplinary loyalties, or the perception of certain resources being more credible than others (Marien, 1991). Awareness of these biases will make us more receptive to aberrant or assumption-challenging events or trends that allow insight into likely future opportunities or threats, thus providing advanced warning by detecting "weak signals" of impending problems. This is an essential first step in identification of slowly emerging problems that may then be further explored with techniques such as Delphi or modeling. Environmental scanning benefits from the increasing amount of information available online, including unconventional or "fringe" resources that might otherwise remain inaccessible. Due to an ever-expanding amount of information, automated filtering techniques may also prove useful.
Scanning efforts may be implemented at local, regional or global levels. For example, as part of their recommendations to the United Nations Development Programmes's African Futures project, Gordon and Glenn (1994) suggest an ongoing environmental scanning system that includes review of selected electronic databases and printed journals relevant to social and technical developments in that region. An expert panel will engage in a continuous scan and enter critical items in an environmental scanning database. For each item, criteria such as anticipated severity, closeness in time, number of people affected, and "catalytic potential" will be assessed. In order to move issues identification closer to problem intervention, the expert panel will also create essays exploring long-term issues with policy recommendations.

In addition to increasing the diversity of information resources used in problem identification, we must also find ways to increase the participation of those typically excluded from planning activities. The value of interdisciplinary collaboration has long been recognized. However, to achieve a true global view of a problem, we need also incorporate the participation of individuals, including "non-experts", at multiple local levels. Increasing the breadth of participation will assist in the identification of aberrant events and patterns. Electronic focus groups present one possibility of gaining rapid feedback from many geographically-dispersed participants, and may cost as much as 50 percent less than traditional methods ("More firms turn to online focus groups", 2000, November 20).

Another area to be explored is the expansion of an on-line and on-going problem-oriented Delphi technique--a continuing and focused telecommunication problem summit. Computer-mediated communication creates a number of possibilities for enhancement, including the replacement of the traditional Delphi 'round' structure with a continuous feedback process, the application of collaborative expert systems, and the use of multimedia tools for enhanced visualization (Turoff & Hiltz ,1996). An online system would provide a method for harnessing a diverse, culturally balanced, set of experts on any particular problem. This might also reduce some of the time- and cost-related constraints common to traditional pencil and paper data collection. Qualitative and quantitative inputs could be solicited from participants around the world. Trend levels and event probabilities, along with cross-impact coefficients, could be obtained to develop very sophisticated models of highly complex, interrelated and long-range problems. New problem landscapes exploring the numerous interconnections between problems in seemingly unrelated domains or regions can also be developed, perhaps following or building on the work and frameworks of the UIA Encyclopedia Project <http://www.uia.org/>. New ways of imaging and exploring the future certainly benefit from emerging human/communication interfaces.

2.3 New Sciences and Theories

Not only methodological changes have to be made. New "inexact" sciences have to be advanced. The sciences of complexity, chaos theory, catastrophe theory, fuzzy logic and others need to be incorporated in how we think about slowly emerging problems. The research frontier of complexity science takes into account "adaptive systems" with many participants and changing interaction of developments (Axelrod & Cohen, 1999). There are numerous elements in such a system, and these are deeply intertwined and may interact in ways that have significant influence on the probabilities of later events. This seems to be a perfect description of the emerging global communications environment. Related developments in chaos theory illustrate how even the most simple systems can display extremely complex, turbulent behavior that is virtually unpredictable (Gleick, 1987). In a chaotic system, initial conditions may deeply influence the course of later events, the so-called "butterfly effect" (Lorenz, 1993). The elements of a chaotic system appear to be in total disarray, making pattern recognition impossible. For this reason, many traditional forecasting tools (e.g. extrapolation based on existing trends or linear models) are not useful, particularly for time frames beyond five years. However, this does not obviate the need for planning activities. Analysis may reveal a basis for determining where critical leverage points within the complex system can be exploited to reduce uncertainty (Linstone, 1999). Catastrophe theory (Thom, 1975) also describes non-linear systems that exhibit strong sensitivity to initial conditions. In this case, an apparently stable system may undergo abrupt and dramatic changes. This highlights the need to anticipate emerging problems and take *early* action to reduce them. Fuzzy logic posits that "the world is gray, but science is black and white" (Kosko, 1993). The scientific method and the way that we categorize phenomena are based on bivalent logic: an object or event is either a member of a specific, well-defined set or it is not. Fuzzy logic challenges this assumption by permitting partial set membership. As components of a system become more tightly intertwined, interconnected, and interdependent, boundaries become more amorphous (Kash & Rycroft, 1994). While this logic may be counterintuitive and unacceptable for many people, it addresses the ambiguities inherent in the "real world" and may therefore be necessary when forecasting slowly emerging and complex global problems.

2.4 Building New Institutions

Finally, new methods and new theories require new types of institutions. Such institutions may be easier to invent from scratch than re-engineer from existing bureaucracies. Some recently developed organizations/projects show promise. These include:

1. The Benton Foundation "works to realize the social benefits made possible by the public interest use of communications". <http://www.benton.org/>.

2. The Millennium Project based in the United Nations University is "a global participatory futures research think tank" of futurists, scholars, business planners, and policy makers who work for international organizations, governments, corporations, NGOs, and universities. <http://millennium-project.org/>.

3. The World Problem Project is a clearinghouse for information on over 12,000 world problems as perceived by international organizations and other constituencies. <http://www.uia.org/>.

4. The Long Now Foundation "was officially established in 01996 to develop the Clock/Library Projects as well as to become the seed of a very long term cultural institution". <http://www.longnow.org/>.

5. The TeleFoundation anticipates, clarifies and reduces global telecommunication problems and, via its TeleCorps, implements problem solution strategies on a global scale. <http://www.telefoundation.org/>.

While these examples are by no means exhaustive, they suggest that some individuals and institutions have work underway that recognizes the need for shifts in the ways we approach problems. It is one of the premises of this paper that the need for these actions and institutions will grow exponentially in the future.

3.0 The Need for Immediate Identification and Actions on Long-term Problems

From a perspective focused on the present, or the short-term future, problems often seem to appear suddenly, at the point of crisis or "catastrophe". However, a broader perspective reveals that they are often "proceeded by long shadows, long trains of activity" (Molitor, 1977). Problems may emerge slowly, over decades or even the course of a century. Molitor suggests that this development follows an S-shaped curve. As a problem emerges, the number of events, individuals, resources and related communication increases, and it undergoes exponential growth, gaining inertia and passing a "point of no return". Therefore, for effective action to take place, emerging problems must be identified early in their development, before they have reached "critical mass".

The costs of delaying actions on large, slowly emerging global telecommunication problems are very high. It is relatively easy to postpone actions, or ask the question, "what is in it for us now?" One could ask the same question in two years, ten years, perhaps twenty years. What is clear is that waiting for a state of crisis significantly increases both the costs and the timeframe for noticeable results once actions are necessary. Investing time and resources, anticipating, identifying, profiling and reducing global telecommunication problems at an early stage not only has direct benefits for the initial concern, but given the nature of telecommunication and information in society, it can make a very substantial contribution to the reduction of second-, third- and fourth-order related (so-called "pin-ball') problems. It is the "amplification effect" of action or inaction on slowly emerging global telecommunication problems that generates the need for anticipatory actions to be taken in the short term. If detected early enough, we are afforded the opportunity to ask, "what actions can be taken *now* to avoid the possibility of this problem in the future?" We might also ask, "what other related problems might this action mitigate?"

4.0 Identification and Profiling Telecommunication Problems

Slowly emerging telecommunication problems, even when started to be understood, tend to be handed off to later generations or held for later "techno-fixes". Problem definition may be complicated by the assumption that a problem either exists or does not. "Fuzzy" problems defy clear definition or even pronouncements of when they are threatening enough to be rounded off to the conclusion: "yes, we have a problem." These problems need to be identified early and profiled clearly. We must therefore be on the lookout for "leading events", unusual occurrences that at first appear unique, bizarre, or otherwise unworthy of notice (Molitor, 1977). When these leading events are brought together and aggregated into useful clusters, they can then be subjected to analysis and key trends or patterns may be discerned. It is at this stage, when they are still "fuzzy" and have uncertain boundaries, that initial action must occur.

Communication is a foundation for every aspect of human activity, and resolution or exacerbation of telecommunication and information-related problems is likely to have substantial spillover effects on other problems, even those that are not primarily telecommunications related. A problem that appears "unique" at first glance may actually be part of a "problem network", affecting problems in many other spheres or geographical regions. Therefore, developing an understanding of the extent and magnitude of these interdependencies is essential. Once we begin to understand these networks, we can determine which problems are the most influential and deserving of priority attention. Because not all problems can be directly addressed, mechanisms need to be developed to prioritize and manage a portfolio of slowly emerging global telecommunication problems that appear to have strong linkages to other large global problems. As the portfolio is being developed, work can begin to prioritize actions and address specific problems.

5.0 Examples of Slowly Emerging Global Telecommunication Problems

Probably the most widely known global telecommunications problem is the telecommunications development gap between developing countries and developed countries. This problem was clearly identified, profiled and sensationally reported to the world in the ITU' s *Missing Link* report in 1984. Ono (1997) looked into the nature of the gap and showed that it consists of quantitative and qualitative factors. Unless both factors were effectively resolved, we could not claim that the gap has become a marginal problem in the world telecommunications arena. The telecommunications gap in the world, if it is holistically examined, can still be considered a global problem.

Ono points out that this problem ("effect") is in fact a complicated product of 23 different kinds of sub-problems ("causes") ranging from policy, planning, financing, technology, human resources development to social systems. He suggests that the telecommunications gap cannot be resolved without reducing the negative impacts of those sub-problems. Further, a comprehensive understanding of the extent and magnitude of the cause-effect ("linkage") relationships is an unavoidable path in tackling any critical problem.

Because of the birth and the subsequent dynamic growth of the Internet, the telecommunications development gap problem faces a new twist. This has to do with the different speeds with which the transformation of telecommunications networks from the "telephony-centered network" to the "information-centered network" is taking place. In many of the least developed countries there is still a long way to go to achieve sufficient development of telephony-centered telecommunications with just minimum basic services. At the same time, one of the emerging trends in technologically and economically advanced countries is the rapid build-out of information-centered telecommunications networks. These carry not only voice signals but also text, audio and video data signals. The construction and enhancements of the new generation of telecommunications networks push the traditional telephony-centered telecommunications networks to a marginal position.

This concurrent development of two-layered telecommunications networks in the world can become further problematic as information and communication needs beyond voice communication rapidly grow. The dichotomous development can be considered a slowly emerging global problem, and therefore, requires immediate attention and actions. Not to do so will set long-term conditions for the expansion of an already unacceptable telecommunication divide.

Another potential problem can be found even in something that appears to be successful in the present. One such hidden or developing problem could be the unexpected repercussions of some broadly pursued policy measures (e.g. privatization and competition). In order to accelerate telecommunications development, the former PTTs were privatized and competition was introduced in many countries. The key premise underlying the competition and privatization policies was that they would bring about greater efficiencies of the telecommunications operators and, in turn, would lead to better and cheaper services to users. Given the gradually increasing installation base of fixed telecommunications connections, and the sharp growth of wireless connections especially in developing countries over the past decade (Wellenius, Braga & Zhen-Wei, 2000), it would be safe to conclude that those policies, in the short term, have played an important role in facilitating telecommunications connections in many parts of the world. In the longer term, however, this may turn out to be an inaccurate or inadequate conclusion.

Telecommunications development should not be solely evaluated from an economic perspective. As telecommunications are fundamentally concerned with people, the development of telecommunications profoundly impacts all social and cultural aspects of people's lives. If telecommunications development continues to be promoted primarily on policies overly focused on economic criteria other problems may emerge. For example, the social costs of an endless race toward newer and cheaper services and cultural costs like the marginalized value of cooperation and contribution may become too large to endure. These costs have so far been sidestepped. It is quite dangerous to hold the belief that a successful policy in the present will continue to be such in the future. Whether or not the present balance between the economic benefits and social and cultural costs of competition will continue to prevail is a crucial question to be asked now. A strong belief in, and unquestioned support of, intensifying competition could slowly become a global problem.

6.0 Problem Reduction Strategies

There is probably no such thing as a "global solution" to a complex, slowly emerging telecommunication problem. What is more prudent is to implement significant "problem reduction strategies" at local, multiple-local, and subsequently, at global levels. Global problems are often expressed differently on local levels. The formation of a local solution must involve individuals and organizations that experience the problem. Consequently, local telecommunication problem reduction strategies may differ significantly depending upon the local cultural, technical, political and economic settings. On another dimension, problem profiles may appear to be parallel in nature when described, but the proposed reduction strategies many times will differ significantly in developing and developed environments (Ono, 1997).

Once the problem is anticipated and described in enough detail to understand its elements, linkages, claims and counter-claims, it is important that alternative strategies are developed, operationalized and tested in the field.

A team, or "corps," of highly selected and "locally sensitive" professionals should be dispersed to the location and develop a plan of action to significantly reduce the "profiled" problem. The team would establish the timeframe, associated organizations and explicit measures for success in the project. Once the "proof of problem reduction" was demonstrated, it would be the responsibility of the team to "hand-off" the strategy and the project to appropriate entities (new or existing non-profit or for-profit) and disband. In some cases this handoff could prove to be quite profitable, while the aggregate effect of local solutions may contribute significantly to the reduction of the problem on a global basis.

7.0 Costs and Rewards for Reducing Global Telecommunication Problems

There is little doubt that efforts to profile and reduce global telecommunications problems will require substantial financial resources and human effort. Expected costs include:

- Electronic and printed resources from a variety of domains (inputs to the scanning process);
- Printed and electronic communications to support coordination efforts;
- Development and maintenance of computer-mediated communication systems (e.g. TeleSummits, online scanning, Delphi, focus groups, etc.);
- Identifying and reimbursing experts or other participants;
- Establishing and running a profiling/linkage and database system to manage emerging problems;
- Training and deployment of (multiple) teams to address problems;
- "Issue awareness" strategies and campaigns;

- Fund-raising efforts; and,
- Other operating costs for organizations/linkages involved in the process.

Given the costs and complexity of what has been set out above, it is a fair question to ask "why would any institution or individual be interested in investing in, or taking on the challenges of, such problems?" The answer is that it is a clear investment in the development of local and global "social capital." When social capital is expanded, especially in the manner in which we handle human communication and information, it has substantial spillover effects on other problems. It amplifies other problem reduction strategies. Further, these activities serve to enhance communication at many levels, heightening our ability to respond to anticipated problems. They are a means for "'wiring up' the negotiating system" between different social actors (Grupp & Linstone, 1999). Although there are many risks involved, even a slight reduction of uncertainty is significant and will produce substantial returns.

8.0 Conclusion

The major premise of this paper is that reducing long-term, global telecommunication problems promises substantial and broad-based returns in a number of areas. An increasingly complex global environment increases the need for early detection and management of emerging problems. While we will never be able to forecast with precision the development of complex socio-technical systems, we can increase the probability of desirable outcomes, while reducing the probability of undesirable ones. One could argue that the way we will handle communication and information on our planet is of fundamental concern to long-term human quality of life, in some cases survival.

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Back to top of page **Back to the sessions page**

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Go to proceeding page **Back to the sessions page**

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Go to proceeding page   Back to the sessions page

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Go to proceeding page **Back to the sessions page**

Needs For And Benefits Of A Private Telecommunication Operating Foundation

George J. Lissandrello

Abstract

It is understood by those involved in applications and services dependent on telecommunication, and those that provide telecommunication products/systems/services, that there is a need for the early identification of the problems being created by this ever expanding telecommunication based world. Governments and regulators, and the telecommunications industry and its customers need organizations that are impartial, objective and expert to identify such problems and reduce them to a manageable point. These are problems of telecommunication and those caused by telecommunication. A private operating foundation fulfills such a need by addressing problems that range from the technical to those that are by telecommunication such as economic, social, cultural and political. By addressing and coming up with methods to reduce the problems, as well as implementing the problem reduction projects, the foundation will provide economic benefits in a multitude of ways to all those affected. At a logical point in the process of reducing problems the projects will be turned over to the appropriate party or parties. This paper describes the specific needs for such a foundation by identifying examples of problems of and caused by telecommunication. It will also show how the results of problem reduction will benefit providers of products, systems and services; nation states; regions; and the users/customers. A summary of a methodology will be presented how such problem reduction can be implemented and how it can be transferred to the appropriate party or parties. How the parties will benefit will also be described and how the interested parties can participate in the foundation through donations, contributing expertise and becoming advisors to the foundation's board and executives.

A private operating foundation conducts its own projects and programs as opposed to a non-operating foundation that funds projects and programs for others through endowments. Private operating foundations are not well known. Out of the more than one million nonprofit organizations and the fifty thousand private foundations in the USA today, only some two thousand are designated as private operating foundations. Obviously if you extend that to the number of foundations world wide the percentage of operating foundations as to the total is much less and less well known. As a foundation type it is relatively recent in the US, having been defined only as part of the US tax reform Act of 1969.

A private operating telecommunication foundation that anticipates, clarifies and reduces emerging global telecommunication problems can benefit both nonprofit and for profit organizations. Such a foundation will have the ability and resources to develop profiles of the problems through a well defined methodology; conduct projects that address the reduction of the problems; and demonstrate the strategies/actions used to reduce problems to a manageable level. The implementation of such strategies and actions can be through either an arm of the foundation that operates as a telecommunication version of the Peace Corps or through another nonprofit or a for profit organization. In addition it can be expected that private operating telecommunication foundation will use state of the art IT and manage its operations based on the Internet and the availability of satellite and terrestrial wire/wireless services.

The Union of International Associations in Brussels has prepared profiles of more than twelve thousand global problems including those of telecommunication. Some other problems that have been identified arise from an absence of, constraint on, or blockage of telecommunication. Such problems of are immediately obvious when disaster-relief efforts are stalled by the absence of the telecommunication and information services required for emergency purposes.

Global problems often appear at first to be ill-defined entities. While formal definitions are likely to be of limited use, good descriptions are essential. A global problem can be described by providing detailed information on several of its attributes. Following this approach, any global problem may be described as including but not limited to the following attributes:

- Long-term, up to a decade or more
- Persistent and pervasive
- Affecting many people
- Difficult to establish ownership
- May affect the world in its entirety or -
- May exist from time to time in many communities
- Reduction strategies often require new forms of collaboration

Basic universal problems tend to be of a scope and scale that no single organization can claim to adequately address them in all aspects such as: maldistribution of resources, man-made disasters and lack of information.

Detailed problems that are both basic and cross sectoral and include a telecommunication element as examples are: technology gap between counties, excessive television viewing, and avoidance of copyright.

The slow emerging and not well defined problems also referred to as Fuzzy Problems tend not to find their way onto the work agendas of international organizations. They may seem unusual and little connected to other problems. They may be seen as dormant, of low probability or intangible. They may be ignored for political or monetary reasons. Some examples of these include: inadequate use of information technology, maldistribution of telecommunication facilities within countries, and prejudice against communication by visual imagery.

Real-life examples of slowly emerging global telecommunication problems are caused by the increasing complexities of telecommunication on a global scale and the increased dependence on telecommunication. This environment generates or gradually exacerbates problems of access, cyber-terrorism, bandwidth/service shortages, and network crashes such as the slow down and potential failure of the current Internet.

The recent US Presidential Election has allowed for the identification of a slowly emerging problem with the voting process that has now reached a critical stage since it had not been identified early enough or it had been ignored. It is unbelievable that the high technology country of the world and a leader in telecommunications is using such antiquated equipment and methods of communication for voting and the counting of ballots. It is also interesting to note that the media with its instant polling through non high tech means contributed to the way people voted or non voted. However, this is an opportunity to reduce the problem in the US and other parts of the world through telecommunication. This problem should be included in the list of those to be addressed by a telecommunication foundation.

A telecommunication foundation makes extensive use of the available technologies to manage its charitable affairs, develop its problem profiles and conduct its projects. Through its projects, a foundation facilitates future oriented solutions to carefully selected communication and information problems.

Once a problem has been selected it is profiled. A profile describes a problem and suggests at least three ways the problem might be reduced. Using this methodology the profile is divided into four narrative elements that are called description, incidence, claim and counter-claim. Each of these narrative elements can be converted into simple interview questions as follows:

- Description: How do you describe that problem?
- Incidence: Who suffers most from this problem? How do you know?
- Claim: Why is this problem important to you?
- Counter-claim: Why do some people think this problem is not important?

The problem profile generates concise information for each of elements based on the interview questions.

The problem reduction research of a telecommunications foundation is carried out through its various projects. These projects employ a wide range of methodologies and are multimethod, multicultural and multinational. While an operating foundation conducts its own projects, project proposals will be prepared as if they are to be submitted to outside agencies since in most instances it will be the case.

A telecommunication project team will be assigned to come up with a demonstration program to address the reduction of the problem. Once demonstrated, programs can be transferred, on a non-discriminatory basis, to for profit and nonprofit organizations for global scale implementation. The project design anticipate the transfer requirement. When existing organizations do not choose to implement the reduction strategies developed by the project teams the demonstrated program is turned over to the foundations telecommunication corps.

The telecommunications corps serves as the implementation arm of the foundation. It undertakes to implement problem reduction strategies usually under challenging conditions and often in poor, rural and remote areas.

Telecommunication manufacturers, service providers and systems integrators can benefit from to take on a demonstration program and develop a global solution, which can result in profitable products, services and systems. As an example a new type of national telecommunication infrastructure for developing, underdeveloped and newly industrialized states can be one of the demonstration projects. This type of project addresses the reduction of the problems of access, bandwidth shortages and network crashes.

The demonstration project for the national infrastructure would be based upon a wireless solution, using satellites for long haul and fixed wireless for the local loop. New methods of dynamic bandwidth allocation will be included. Software will be developed for network control centers and for an overall command and control system for the services. By taking over such a project a company involved in telecommunication can come up with new and innovated hardware and software products, new services that are competitive, and new overall system solutions.

There are other benefits for both for profit and nonprofit organizations, which include collaboration with the telecommunication foundation on research, and in developing demonstration programs. In addition there can be co-sponsorship of conferences and meetings that address emerging global telecommunication problems, and collaborative development of web based interactive project activities. The foundation offers other organizations the opportunity to donate funds and resources to the foundation and to participate as an advisory board member.

A nonprofit telecommunication operating foundation will fulfill a need and be a major force in reducing global telecommunication problems. It will benefit nation states, users and the providers of telecommunication products, services and systems.

Business & Applications

Monday, 15 January 2001
1400–1530

M.2.2 The End of the Line

Location: South Pacific I/II

Chair: JAMES HERBLE, VP Sales and Marketing, Monterey Telecommunications Technology, USA

M.2.2.1 Pervasive Computing–Connecting the World (ABSTRACT)

THOMAS C. AGOSTON, Asia Pacific Service Delivery Manager, IBM Global Services, *USA*

M.2.2.2 The Potential of WAP for the Delivery of Health Online in Australia (ABSTRACT)

ROBYN A. LINDLEY, Vodafone Australia; LOIS BURGESS, Lecturer & PhD Candidate and JOAN COOPER, Professor, School of IT and Computer Science, University of Wollongong, *Australia*

Pervasive Computing -- Connecting the World

Thomas C. Agoston

Abstract

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http://www.agoston.com/Tom_Agoston991.html

Technology is moving from PCs to hand held, intelligent and everyday devices with embedded technology and connectivity.

Pervasive computing provides convenient access to relevant information and applications through a new class of ubiquitous, intelligent appliances that have the ability to easily function when and where needed. The name "Pervasive Computing" tells only part of the story because a parallel revolution lies in network-enabling these pervasive computing devices by providing transparent, ubiquitous access to e-business services. At the most recent international Telecom 99 conference in Geneve, the global Telecommunications Carrier industry focused on the "information" industry. Concepts such as "wireless Internet" were hot. However, even telco carriers need partners in order to cover the breadth of disciplines necessary to provide Pervasive Computing services successfully.

The long-promised paradigm shift of "**convergence**" finally may be occurring. Virtually all types of information technology companies are targeting the same area: hardware (personal computer, Palm and other personal organizers, routers, switches, consumer electronics), software (operating systems, application, middleware, network management), Internet Service Providers, telcos, wireless and other service providers, consultants, network and system integrators, along with broadcasters, cable TV and content providers. Thus, cross-industry partnerships and other linkages combining respective expertise are becoming quite commonplace. But Pervasive Computing is like a Rorschach inkblot -- different viewers see different subjective opportunities in this emerging market space.

First, a definition. If we say that Pervasive Computing means: "Anytime/Anywhere-->Any Device --> Any Network --> Any Data" then let's look closer at these elements:

Anytime/Anywhere: 7 days x 24 hours, global, ubiquitous access
Any Device: PC, Palm/PDA, Cellphone, etc.
Any Network -- Wired or Wireless: (Access, Notification, Data Synchronization, Queued Transactions, Wireless Optimization, Security, Content Adaptation/Reformat, Development Tools, Device and User Management.)
Any Data or Service: e-mail, Personal Information Manager (PIM); Inter-Intranet; Public Services.
Vertical Application Solutions (Banking/Finance, Sales Automation, Visiting Specialist), Horizontal Application Solutions (Supply Chain Management (SCM), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM))

Extending e-business:
The author's employer IBM, along with other total solution providers, is focusing on building some of the necessary technologies: embedded software, speech technology, low power management, mobile storage, network administration, subscription management, content transcoding (i.e. from HTML to WAP), backwards compatibility, wireless transmission, and security, (i.e. for equity trading). Another focus is an in-network

Service Delivery functionality that connects existing content (i.e. a financial institution such as a stock brokerage) to end-user devices, and provides security, transcoding, and user management. This platform also enables service provision, acting as a Pervasive Services "Utility," and will be accompanied by a client enabling easy connection. To deploy services, we are collaborating with carriers, telecommunication equipment manufacturers, automobile/device manufacturers, financial services companies, and enterprise application vendors.

A major requirement is integrating all this technology to deliver real *solutions* to users. For example, Banks and Securities Brokerages want to link existing financial trading systems to wireless networks. The same holds true for the Travel industry and its reservations systems, not only due to the convenience of directly reaching their customers, but for added real-time functionality -- for example, sending a message to a passenger that a flight is delayed, and listing three alternative travel options, or in Health Care for enabling immediate access to patients' medical records. Telematics and the "Network Vehicle" promise network-connected clients in cars, not only for driver navigation and communication, but for connecting the vehicle to the manufacturer and maintenance/service providers. Such networked services enable new relationships between these providers and their customers.

Currently, we are witnessing the emergence of "e-Marketplaces," global web-based trading networks allowing buyers and sellers to conduct business on-line. These cybermarkets act as neutral intermediaries and provide mediation, liquidity (critical mass of buyers and sellers), as well as value-added services (i.e. supply chain, procurement, sales…) which enhance business capabilities, and ultimately change business processes to become more efficient. Whereas e-Commerce is a transaction-centered business model used to buy and sell goods (i.e. from a static price list), e-Marketplaces facilitate any-to-any transactions more broadly via dynamic pricing, collaboration, auctions and exchanges. Examples of leading public e-Marketplace pilots include Worldwide Retail Exchange (Retail); Enron Online (Energy); FreeMarkets (cross-industry); Covisint (Automobile); and e2open (Electronics, Computers and Telecommunications). Some companies and industries are also establishing private, closed e-Marketplaces for their internal trading communities and procurement processes.

The Web continues to prove its value to business by linking numerous players; Pervasive Computing promises even more interaction between them:

Suppliers (Commodity, Strategic, Component)
Customers (Catalog Shoppers, Solution Communities, Prospects)
Partners (who provide Added-Value)
Employees (Sales, Marketing, Technical, Finance)
Influencers (Press, Consultants, Shareholders, Communities of interest)

Pervasive Solutions enable anytime, anywhere information exchange and access to applications.
From a business perspective, networked applications involved in Pervasive Computing include:
Industry Applications: Travel, Healthcare, Sales Automation, Banking, Securities, Media, Health...
Business-to-Business: Web-enabled e-Commerce; Trading Networks, e-Marketplaces, Customer Relationship Management and Global Help Desk (covering infrastructure, middleware, vertical and horizontal applications…)
Business-to-Consumer: Phones; Pagers; PDAs; mobile laptops; screenphones; watches; home appliances; automobile electronics...

Pervasive Computing is valuable to consumer and business users because of today's environment: global (anywhere), 24x7 (anytime), and business requirements to: increase revenues (new channels, markets and transactions), improve customer service (loyalty, competition, differentiation) and decrease costs (increase efficiency, decrease cycle time). For many workers, professional and personal lives are increasingly merging; Pervasive Computing can enable such stressed workers to optimize their time by enabling business and personal transactions anywhere, anytime. Some typical uses might come under the follow models:

Query←→Information **Action←→Transaction**

Communications: e-Mail/Messaging, Paging, Scheduling, News, Finance, Sports...
Professional Productivity: Sales Force Automation, Order & Delivery Confirm, Contract Signing, Medical Prescriptions, Travel Reservations, Insurance Claims Processing, B2B e-Commerce.
Customer Relationship Management: Banking, Equity Trading, On-line Bill Payment, Entertainment Ticket Purchase, Medical Data Access, Mobile Shopping, Delivery Status, Travel Reservations, B2C e-Commerce.
Business Process (SCM, ERP): Asset Tracking, Dynamic Distribution Management, Remote Diagnosis, Health Care Monitoring, Medical Access to Patient Data.

Net extensions:
In early 2000, many news articles appeared about appliance firms planning to link their products to the Internet for maintenance, product orders, and upgrades, including announcements of strategic alliances between appliance manufacturers and technology companies. Announcements included: an exercise machine maker that plans to equip its products with free Web service - so that a technologically-oriented lifestyle needn't be sedentary (Nettles Communications Inc. 1/21); elevators in commercial buildings equipped with 10-inch Internet display screens that continually deliver news, financial data and advertising customized for each captive audience (aptly-named Captivate Network Inc. 1/15); a convection microwave oven that downloads recipes and automatically sets the time, adjusts the power and does the roasting, baking, broiling... (Sharp Electronics Corp. 1/17); a net-connected refrigerator with bar code-based food tracking and reorder capability (General Electric 1/18); and other "command center" and "Home Gateway" technology. Manufacturers are estimating Web appliance availability in 2001. All of these reports add to the promise of Pervasive Computing and its revolutionary possibilities (for the developed world) as the Web's connectivity spreads globally.

High Tech / High Touch: "Dick Tracy" Wrist Devices and Body Piercing:
As in real estate where "location, location, location" is key, the wrist is seen by some as the most accessible place on the body. Thus, companies promise consumer wrist devices that have function lists as long as your arm, doubling as: cell phones, pagers, e-mail readers, computers, cameras, MP3 music players, television receivers, voice recorders, automobile security keys, VCR remote controls, health monitors, weather stations, Global Positioning System navigation receivers, altimeters, and games. With an active transponder, some can function as admission passes for ski lifts and museums. And, almost as an afterthought, they tell time. (Motorola, Samsung, Timex, Seiko-Epson, Casio, others. 1/20) [i]

Another possibility is that of Body Piercing - which brings to mind the "Form or Function" dichotomy - is it merely decorative or functional? One might soon hear "That's not a xxxxx ring, that's my transponder!" If a user balks at the decorative aspects of wearing a high-tech piercing device, there soon may be an option for *embedding* technology inside one's body, but let's leave this topic for another time.

Challenges Facing Pervasive Computing
Standards Issues: The lack of established standards continues to pose problems, and battles are emerging similar to that which occurred between Betamax and VHS in the home-video industry. Ignoring for now the competing wireless standards like Wireless Application Protocol (WAP), Bluetooth and others -- producers of competing software enabling different Internet Appliances to talk to each other are making their case with appliance manufacturers. At a January Builder's show, GE and Maytag announced they would join Microsoft in developing technology solutions and standards for "smart" appliances by joining the Universal Plug and Play

Forum (UPnP), a cross-industry group of more than 65 companies, including Sony, IBM, and Intel. But GE also has a similar agreement to use Sun's Java and Jini technology. In addition to its deals with Sears and GE, Sun has agreements with Whirlpool, Bosch Siemens, Motorola and Cisco. Sears has announced several non-exclusive agreements. At this time, a dominant standard is elusive.[ii]

Other challenges facing Pervasive Computing include: battery technology, security concerns, multiple devices per user and resultant "Gizmo fatigue," synchronization, personalization, consistent worldwide coverage and scaling up to millions of users!

Voice: Natural Speech will be an additional interface for pervasive devices.
Previous paradigm shifts in computer technology included moves from mainframes and connected monochrome "dumb" terminals to Personal Computers, and later from keyboard-input, text-based PC Operating Systems (i.e. DOS) to mouse-controlled graphics interfaces (i.e. Windows). Much current research and development work focuses on the next coming shift: natural language interfaces for pervasive devices, which will lead to "transparent computing" -- access to devices and services bypassing the current dependency on keyboard input/output in favor of plain speech. The ability to use natural language will clearly benefit technology users who are not proficient with a keyboard (including the author).

In order to be useful and practical, transparent or speech-based computing has three major requirements:

1) Recognition - the device must be able to hear correctly,
2) Comprehension - the device and system must be able to understand the meaning, including context ("Do what I mean, not what I say.")
3) Audio Response System - the device and system must be able to create conversations, exchanges and transactions - to clarify, confirm and execute the desired action.

An example of natural speech's future potential as an integrated feature of pervasive computing is automobile manufacturers foreseeing the car as a "voice portal." Such a portal would use voice commands to connect the driver to the car manufacturer for directions/navigation, travel recommendations, entertainment guides, sporting event tickets, and of course -- car maintenance and additional sales. VoiceXML is a technology which can add voice interfaces to web pages for multi-modal web surfing, enabling a "voice browser" to access the same information as today's PC web browser. By integrating voice with other systems, we may soon witness on-line auction sites calling a bidder on the cellphone to offer a last chance to raise the bid. The promise of unified messaging can tie together voicemail, e-mail, fax, pager and other forms of messaging.

Natural speech-based Transparent Computing technology continues to evolve, and it is clear that speech will be an additional (if not the next) interface.

Cultural and Social Aspects: Comparing Japan and the US.

Worldwide, the US is the leading market in terms of overall e-Commerce adoption, judging by transactions using 800 toll-free telephone, Direct Marketing, and e-business web sites, but Japan leads with devices and connectivity networks supporting emerging applications. e-Commerce growth is lagging in Japan partly because of a cultural preference for face-to-face transactions, especially in the Business to Consumer (B2C) market space (which was still Y 248B or US $2.4B) in 1999. [iii]

Does this disparity imply two different futures for Pervasive Computing or, due to cultural differences, merely divergent paths leading to common networked applications?

First of all, we need to examine the drivers of Pervasive Computing. An important fact is that people generally do not adopt new technology merely because of its novelty. Although there is a small group of users who are constantly looking for the latest gadget to satisfy their interest in leading edge technology and stay ahead of the general public, these users do not create critical mass. Years ago, some early adopters were willing to pay $5 a minute for cellular phone services. Note that the Internet was already available to academic researchers long before the Web arrived. However, what wove those services into our daily life was not the technology itself but the *convenience* it brought. Convenience varies from place to place, and occasion to occasion. Taking a less than a minute walk to a nearby convenience store is more convenient than driving ten minutes to a supermarket. Pumping some gas into one's car during the commute home is convenient, but having to do the same on a weekend may not be. What seems convenient here and now may be inconvenient in different circumstances. Mobile computing has become popular by closing gaps in different circumstances when a user performs necessary tasks.

It is also important to understand the purpose of an action that makes a new technology convenient. Pumping gas is not a necessity for people who regularly commute by train. Being able to order books on-line are not a convenience for people in places where bookstores exist right where they catch trains daily (as is the case in Japan). The point is that Pervasive Computing will have distinct forms of adoption depending on how people behave socially. What needs to occur differs from society to society depending on existing social and cultural systems, and what "pervasive" stands for may also be quite different.

Technology is a basic driver of Pervasive Computing, but people's behavior is the ultimate determinant, dictating unique factors by country, culture, region and industry.
Let's compare the business and consumer sides of Pervasive Computing in Japan and the US. Businesses are always in need of effective communication. Whether interpersonal or intercorporate, the speed, accuracy and quality of information exchanged are vital attributes of business competence. Nevertheless, there are different approaches among cultures to achieving the goal of sharing (or not sharing) information effectively. Management styles vary. The general tendency of people to distinguish job-related interpersonal relationships from personal relationships varies. The way people live outside of work varies. Specifically, the US business management style is more open to allowing employees to work within a prescribed process, and providing information resources to let them work effectively within that process. In contrast, Japanese management tends to require interpersonal decisions to move processes forward, and often information resources are found within the boundary of a person who assumes responsibility for the information. In this context, when it is management's decision to adopt new technology, Pervasive Computing will be adopted differently. In the US, Pervasive Computing will give everyone the same standing, but in Japan it may be a means to create more controlled layers or groups of information access. The point is that Pervasive Computing has distinct forms of adoption depending on how people behave socially.

On the consumer side, convenience stores provide a ubiquitous retail outlet presence for urban Japanese. Convenience stores are readily accessible in both residential and business areas, often located literally just a few steps out the front door. In contrast, Americans have come to depend on the automobile or other forms of transportation for access to retail locations -- hence the greater appeal of "couch potato" e-commerce including home delivery in the US. The Japanese market does not have a strong demand for IP-enabled refrigerators monitoring contents when food retail outlets are immediately accessible.

Differences are illustrated in consumer behavior. Internet use in the US has substantially impacted the way people shop, educate, trade stocks, manage finances, and participate in politics and community activities. Japanese use of the Internet is still more at the level of novel entertainment or advertising. This contrast comes from different necessities of having computer-enabled information access at home; only about 45% of Japanese households have a PC. While US consumers may look for information about products and services on the Internet, Japanese consumers often already have such information due to a much higher exposure to advertisements, magazines and newspapers they read while on the train while commuting, or from ubiquitous billboards visible on most major streets. For shopping, Japanese retail shops are located within a few steps of offices, train stations and homes. In such a society, it makes more sense to go out and buy what's needed rather than logging on and surfing the net. Pervasive Computing offers ubiquitous access to information without requiring much user effort. US consumers may welcome this as a radical change in information access, but Japanese consumers may see it as redundant. The value of Pervasive Computing in a society such as Japan where people closely communicate and share common means of engaging in social activities may be in enhancing interpersonal communication. As mentioned later, sending and receiving messages on hand-held devices is already in great demand; enabling devices to interface with others will greatly accelerate Pervasive Computing.

Different ways people embrace technology and incorporate it into daily life:

Technologies can change the way people work, live, and travel. Many first world citizens are coming to depend on various appliances and devices such as the telephone, TV, microwave. For many, it would be difficult to live without the convenience and services these provide. The future may offer enhanced wearable devices (in addition to hearing aids and pagers, imagine a self-service check-out at the cashier-free supermarket, debiting the customer's account via a identity transponder worn on the body), embedded devices (a blind person with brain-embedded visual sensors), and perhaps high-tech piercing as mentioned earlier.

Home appliances already have adopted Pervasive Computing functions in Japan. Some appliance manufacturers have introduced microwave ovens that download cooking recipes from the manufacturer's server. Although not net-connected, rice cookers have long been equipped with microchips that control the heating sequence. Air conditioners also have used sophisticated temperature control employing "fuzzy" logic. All have the potential to become interactive. This sophistication in home appliances in Japan may be attributed to the fact that many families emphasize domestic activities such as cooking, cleaning and maintaining housing. It may take comparatively longer for the US to adopt appliance computerization as households take less time to engage in such domestic activities. In financial applications, the use of cash is preferred by far over credit cards in Japan, and personal checks are rarely used. US society has long adopted cash- less monetary settlements (i.e. credit/debit cards, personal checks) which can be easily converted to the use of pervasive devices. In this context, adoption of Pervasive Computing may be characterised as interpersonal and domestic in Japan, and business-oriented and social in the US.

Physical Characteristics of Devices

The shape and physical characteristics of pervasive devices also vary. The US lifestyle allows devices to be somewhat larger than in Japan where they need to be as small as possible to gain popularity. Americans generally travel by car; therefore devices are not required to be as light and compact as in Japan where a majority of people use public transportation and walk. In addition, Japanese users tend to be more attracted by style and physical characteristics even if the contents and services are limited. A general tendency in the Japanese consumer market is that devices (hardware) initially are more attractive than contents; the contents provide secondary attraction, and subsequent growth in contents and services. Japanese people's preference for portability will incent manufacturers of hand-held pervasive devices to quickly deliver multifunction devices that are small enough to *wear* on the body rather than being only *hand-held.* For embedded technology such as found in automobile and home appliances, Japanese often purchase more function than they actually need, in the expectation of being able to use services and contents when they become available at some future point. This tendency in product selection may explain the rapid introduction of web-enabled home appliances mentioned earlier. The US market may be opposite: people tend not to buy equipment until contents and services are established and available, which calls for a certain maturity in the industry before device-level competition takes place. In this context, Pervasive Computing may present divided models where Japan leads the equipment and the US leads the contents, as in the home audio/video market today.

Although the US leads with per capita PC usage and penetration, cellphone usage is higher in parts of Asia and Europe. Cellphones are no longer limited to voice communications; customers can have wireless access to banking, travel reservations, and other mostly consumer applications. Nokia and other cellphone handset manufacturers have produced GSM phones complete with a keyboard, screen, and Windows-type interface including browser. In Finland and Japan, school students use small, portable, inexpensive wireless devices to send short text messages to each other (inside and outside the classroom!)

A Pioneering Service: Japan's DoCoMo

DoCoMo, the wireless unit of Nippon Telegraph & Telephone Corp. (Japan's dominant carrier) has sparked an explosion of Japan's cellphone market, now one of the world's largest and most sophisticated. DoCoMo grew from a vision that the future of the mobile business lay not in voice calls, but in data services such as Internet access. As of early 2000, Japan's mobile phone market boasted 50 million subscribers (more than half of which are DoCoMo customers) vs. about 75 million in the US, a country with double the population. A survey released in November by Hakuhodo, Japan's second largest ad agency, found that cellphone penetration in Japan is about 66%. Demand for mobile services has exploded, creating a shortage of DoCoMo's wireless spectrum. It plans to roll out so-called third-generation ("3G") cellular technology, based on the W-CDMA (wide band code division multiple access) transmission standard which uses spectrum more efficiently, in May 2001 -- years ahead of the US and even ahead of Europe's advanced mobile players.

A current example of an early Pervasive service is DoCoMo's "i-Mode," a precursor to 3G services. By November 2000, a DoCoMo portal offered access to over 30,000 web sites employing Compact HTML (C-HTML) so the web contents fit onto the small screens embedded into i-Mode phones. DoCoMo has taken a generally open approach to third-party content providers; typical popular content includes Banking, Travel, and Weather information, but as described below, the primary attractions are *transactions* in these application areas, and to an even larger extent, *entertainment*. The number of i-Mode customers is growing by 40-50,000 new subscribers each day and in November 2000 surpassed 15.2 million total subscribers (12% of Japan's total population!), on track to reach 20 million by March 2001 (the end of NTT's fiscal year), from a zero start in February 1999.

I-Mode's success is already giving Japan a role in shaping the next wave of the Internet. Japan was a follower in the current wave, which centers on surfing the Web via PCs; and was dominated by Microsoft, Intel and US PC makers. The next wave, Pervasive Computing, is expected to be dominated by Internet appliances, cheap, easy-to-use devices like cell phones and game machines that could eclipse the PC as it exists today, as the tool of choice for tapping e-business services.

DoCoMo's success is giving Japan a head start in developing high-speed Internet services that are at the heart of 3G, such as video and interactive games, over mobile phones and other portable devices. The potential of 3G has spurred Japan's computer and electronics giants, who were humbled in the 1990s as nimble US companies bested them in the personal-computer market and European makers dominated the cell-phone business outside Japan. Worldwide ambitions ride on Japan's mobile Internet success as Japanese technology companies are investing vast sums in the belief that working with DoCoMo will give them a lead over rivals when 3G rolls out in Europe and the US in coming years.[iv]

As a first step by NTT Docomo to expand its iMode wireless-phone Internet service overseas, it licensed technology to Hutchison Telephone Co., Ltd. (HTCL), Hong Kong's largest wireless service provider, in which NTT Docomo took a 19% stake in late 1999. This deal allows the same content to be provided to users of HTC's phones, which use a different wireless communication standard. [v]. Mid-2000, NTT DoCoMo was negotiating for a 20% stake in the US's VoiceStream Wireless Corp, until Voicestream was purchased by Deutsch Telecom. In November, DoCoMo announced an agreement to purchase 16% of AT&T Wireless, continued similar investment negotiations with Cingular Wireless (a joint venture of SBC and BellSouth), and also announced plans to take a 20% stake in Taiwan's KG Telecom. These investments are aimed at bringing DoCoMo's next generation mobile phone technology, called "IMT-2000," and its mobile multimedia services into the U.S. and Taiwan. DoCoMo was also reportedly negotiating a similar investment in SK Telecom Co. Ltd. in South Korea. In Europe, DoCoMo purchased a 15% stake in Dutch telco KPN and in September announced a joint venture with KPN's mobile phone division, along with plans to establish a subsidiary in England and a research facility in Germany. DoCoMo is clearly putting a major focus on expanding services globally.

A testament of investors' confidence in the potential for wireless is that the value of DoCoMo's stock, which was listed in 1998 on Japan's stock market in the world's biggest-ever IPO, surpassed that of parent NTT domestic *wireline* carrier in late 1999. Multinational telco equipment manufacturers including Telefon AB L.M. Ericsson, Fujitsu Ltd., NEC Corp., Nokia Corp. and Lucent are working with DoCoMo designing 3G handsets, base stations and services trying to make 3G into a *global standard* so that the same phone can work in Tokyo, Paris or New York. Today, the US has three major standards, Japan its own unique standard, and Europe and a number of countries in Asia use the dominant technology, known as GSM.[vi]

I-Mode Service Adoption, Demographics and Usage:
In Japan, the majority of i-Mode users are in their 20's. Overall, cellphone ("Keitai Denwa") users' ages are spread equally in their teens through 40's, but among users who already have a cell phone, a majority of those in their 30's and 40's don't feel the need to replace their current phone in order to get i-Mode. In contrast, people in their 20's are very quick in upgrading to i-Mode, as a fashion statement and expression of their identity rather than for convenience.

Thus, i-Mode Applications can be separated into two categories -- practical and fashion/self-identity. For *practicality and convenience*, applications offering transactions include:

Banking; due to the lack widespread use of personal checking in Japan, this function is extremely useful for paying bills such as rent by invoking direct electronic funds transfer.
Travel: viewing schedules for commuting and "Bullet" trains (Shinkansen), airplanes, and availability of hotel rooms; reserving tickets and making hotel reservations.
Ticketing: checking availability and making reservation for concerts, movies, and other events.
E-mail: As Japanese commuters spend lots of time on crowded public transportation where cellular voice usage is discouraged, recently many young people communicate by sending e-mail using their phone keypad, rather than talking. While older users find it inconvenient to type messages using a phone, younger users have mastered it very quickly.

Currently, these are four major practical i-Mode applications, but other novel uses are growing such as a planned GPS navigation service for pedestrians. For 300 yen per month basic charge (US$2.70), i-Mode users can see immediately where they are walking on a small map that indicates banks, convenience stores, retail outlets, restaurants, department stores, supermarkets, hotels, hospitals, schools and other facilities. Many databases are available -- some for free, others for a monthly charge of 100-400 yen ($.90-$3.63) -- offering information and guides on restaurants, television programming, financial and business news. Weather reports also can be called up before deciding whether to grab an umbrella. In December, 2000, DoCoMo planned to announce 24 channels of slow speed video including animation, movies, sports, news, financial info, and other content.

For *fashion statement and entertainment* applications:

Chakumero: A melody announces incoming calls: "chaku-mero" is a shortened word for "*chaku*sin (receiving calls) *melo*dy." The music becomes an identity statement according to which melody is chosen. Convenience stores sell chakumero books teaching users to input their own unique melody. As of July, '99, one newspaper's study showed 34.8% of respondents using a chakumero melody instead of a generic incoming ringing. [vii] Although one would expect users in their 20's would have the highest rate of chakumero usage, research indicates that the most frequent chakumero users (47.6%) are in their 40's, followed by 20's at 35.9%. Initially, the chakumero function played only one note at a time, but now 4 notes can be played concurrently, like playing a keyboard, covering 3 octaves with major and minor adjustments.

Music download: Users can download and listen to the latest hits, instead of going to a CD retail outlet.

Screen Saver (*machiuke gamen*): available in 256 colors, perhaps a pure-play fashion/identity statement.

Animated Characters: For 100 yen per month per character such as Hello Kitty, users can receive a different visual of the selected character every day to be used as a screen saver (*machiuke gamen*).

Greeting cards: Users can send color e-mail greeting cards concurrently to multiple people with a color visual such as a cup of sake and a message like "do you want to go for a drink after work tonight?"

Horoscope: This content has been very popular for years, predating i-Mode, particularly among young women. Tokyo Department Store sends mail to i-Mode users linking Horoscope information to special sales.

One additional fashion statement is not limited to i-Mode; many users choose a hand strap or handle for their cell phones primarily for aesthetic reasons. Form over function may rule in some parts of Pervasive Computing!

Conclusion:

Following the rapid advances in information and telecommunications technologies, Pervasive Computing in an increasingly networked world continues to affect more and more of the world's population. We can easily see the practical impact of Moore's law, which predicts the processing power of semiconductors will double every 18 months. The phenomenon of network effects has exponentially expanded the global population of the Internet, and created dynamic new opportunities in the four C's: communications, computing, content and collaboration. More questions than answers exist, more investment is required than profit currently available, but there are plenty of opportunity and revolutionary benefits (and potential pitfalls) for everyone who participates. Although this is a global phenomenon, regional and national social and cultural factors will directly influence the technologies and promise of Pervasive Computing.[viii] In any case, no player should risk being unprepared.

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[i] State of the Art: Look Out! New Wrist Devices on the Loose, by Peter H. Lewis, The New York Times, January 20, 2000, Section G; Page 1

[ii] Appliances to Be Linked to Internet, by Jura Koncius and Maryann Haggerty, Washington Post, January 18, 2000 ; A1

[iii] Even so, the 1999 market for Business to Consumer (B to C) electronic commerce in Japan was 248 billion yen (US$2.36 B), or roughly four times the 64.5 billion yen of 1998, according to a survey from the Electronic Commerce Promotion Council of Japan and Andersen Consulting covering 263 companies running Web sites

for electronic commerce. In addition, if the newly added segment of real estate is included, the size of Japan's electronic commerce market reached 336 billion yen. ($3.2 B) -- Japan Economic Newswire, January 19, 2000

[iv] NTT DoCoMo: Banished Exec Leads Way, Robert Guth, Asian Wall Street Journal, January 23, 2000 Tech Journal

[v] NTT Docomo to expand iMode Internet service to Hong Kong, Nihon Keizai, 1/26/2000, p.1 (translated by Digitized Information Inc.)

[vi] NTT DoCoMo: Banished Exec Leads Way, Robert Guth, Asian Wall Street Journal, January 23, 2000 Tech Journal

[vii] July 22, '99 Nikkei Ryutsu News.

[viii] In July 1999, the author presented a paper entitled "Adventures in Miscommunication: Doing Business in Asia" at the 7th International Conference on Cross-Cultural Communication. For an additional discussion of social and cross-cultural issues, please refer online to: http://www.agoston.com/ICCC092399html.htm, http://www.agoston.com/Tom_Agoston991.html

Back to top of page **Back to the sessions page**

Thomas C. Agoston

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Tom Agoston works for a multinational computer services company as the Asia Pacific Services Delivery Manager, specializing in international e-business services. His education and early professional experience concentrated on telecommunications law, but given the current focus on international business, he is better described as a "recovering" attorney. He has researched the Japanese and Southeast Asian telecommunications industries respectively as a Fulbright Scholar and Henry Luce Foundation Scholar. Tom has served in several professional capacities in Japan, Singapore and the US telecommunications and Internet industries. Recent publications include a technical paper presented at the Internet Society's conference INET 98 in Geneva entitled "Internet Olympics: The Internet's Role At The 1998 Nagano Olympic Winter Games" and a June 1999 socio-linguistics academic paper called "Adventures in Miscommunication: Doing Business in Asia" presented at the International Conference on Cross-Cultural Communication at the University of Louisville. A follow-up presentation on cross-cultural miscommunication in business was delivered in April, 2000 at Thunderbird-EMU's Language, Communication and Global Management 2000 conference. Previous research and publications include The Japanese Telecommunications Services Industry; A Current Business Overview (International Institute of Communications, 1987).

Tom's interests include swimming (to stay fit and somewhat sane), music (from Classical to Fusion to Rock), international travel, language, aviation, amateur radio, theatre and humor. Tom is engaged to Yukari Nishimura, an international marketing consultant; they live in Stamford, Connecticut, USA.

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Back to proceeding page **Back to the sessions page**

The Potential of WAP for the Delivery of Health Online in Australia

Robyn A Lindley, Lois Burgess and Joan Cooper

Abstract

1. Introduction

Healthcare delivery systems throughout the world are evolving towards a common model based on the primary care physician as the key decision maker in specifying and approving treatment for patients and co-ordinating healthcare delivery from the home to the general practice (GP) and the hospital (Health Online). This continuity of care model requires the availability of patient data at the point of clinical contact whether it is in the GP's surgery, the hospital or the patient's own home. However, for this to occur, Electronic Patient Information Folders (PIFs) or medical records would need to be available to healthcare providers and consumers, and a range of information would need to be available for the physician and the patient.

The communication infrastructure of the Australian health system also has a major impact on the quality and cost of national healthcare delivery. In a retrospective review of some 14,000 deaths that have occurred in Australian hospitals over a single year, communication errors were found to be the leading cause of death, and twice as frequent as errors due to inadequate skills [1, 2]. Further, it has been found that about 50% of all adverse events detected in a Sydney study of primary care physicians were shown to be associated with communication difficulties [2].

If we look beyond these statistics, the clinical communication space is interruption-driven in that it relies upon poor communication systems and poor information management practices [3]. The causes and remedies of poor communication within the healthcare system are consequently of critical interest, but up until now, there has been only a limited capacity to design mobile communication applications to suit the specific requirements of the healthcare industry. This is often because healthcare workers have a complex set of information needs, requiring support for mobile communication as well as access to information sources whilst mobile:

In this paper, we begin by briefly describing the open architectural requirements for web enabled distributed networks needed by the Australian healthcare system to be able to participate in the new wireless application protocol (WAP) environment: A proposed joint research and development project involving two universities and a number of healthcare providers, and designed to establish Australia's first test-bed for WAP mobile telematics services in Australia will then be described. We will also provide a summary overview of some of the potential benefits and issues associated with WAP use by GPs in the emerging mobile telematics (m-telematics) environment.

2. Why WAP?

The recent emergence and commercialisation of WAP as a new, open global communication protocol specification that allows mobile users with wireless devices to interact with information and services, offers many new possibilities for the healthcare sector. It has rapidly become the de facto world standard for wireless information and telephony services on digital and mobile phones and wireless terminals. WAP is supported by the vast majority of the telecommunications industry via membership of the WAP Forum (including 75% of handset manufacturers) which continues to be responsible for creating the protocol standards.

WAP takes a client server approach: It incorporates a relatively simple microbrowser into the mobile phone, requiring only limited resources on the mobile phone. This makes WAP suitable for thin clients and early smart phones. WAP puts the intelligence in the WAP gateways whilst adding a microbrowser to the mobile phones themselves. The design philosophy behind WAP technologies is to utilise as few resources as possible on the handheld device, and compensate for the constraints of the device by enriching the functionality of the network.

WAP is designed to work with most wireless networks such as general packet radio services (GPRS), code division multiple access (CDMA), global system for mobile communications (GSM), and time division multiple access (TDMA). The WAP protocols are based on Internet standards such as hypertext transfer protocol (HTTP) but have been optimised for the unique constraints of the wireless environment. WAP documents are written in wireless markup language (WML), similar to hypertext markup language (HTML) for Web-based services. Like HTML, WML is derived from extensible markup language (XML) applications, permitting XML specifications to be translated either into wireless markup language (WML) or HTML. HTML documents can be translated into WML, although the results may not be as effective as writing directly in XML or WML.

One of the main advantages of new WAP for m-telematics healthcare applications, is the ability to enable the user to move locations and for information to be obtained and/or sent without needing to be in a fixed location. The ability of the technology to fit in with the day-to-day routines of healthcare service providers and their patients, and to support home-based healthcare applications, means that communications networks can use much richer models of healthcare delivery. For example, diabetic patients or other high-risk groups, can be monitored whilst they are at home. Clinicians can then deliver feedback with both a mixture of voice and data displays of the relevant information using a WAP handset.

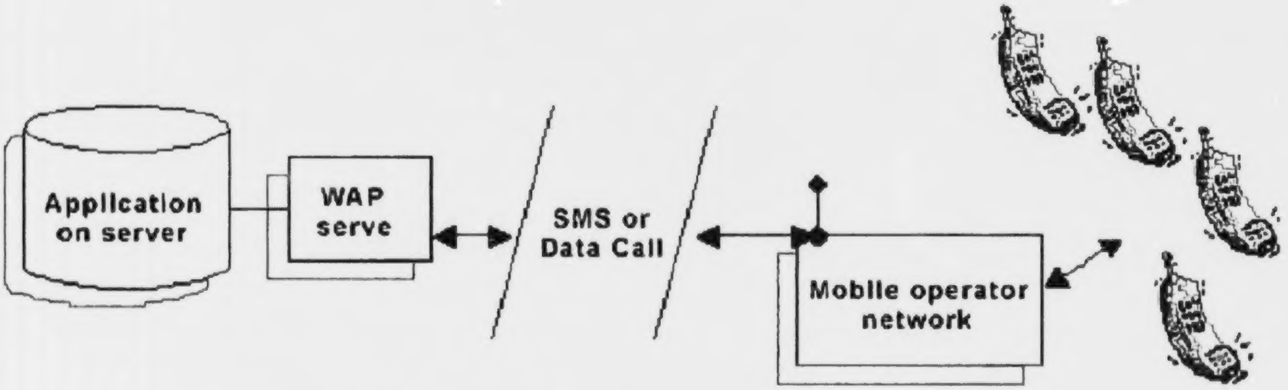

Figure 1. WAP architecture showing how Web services can be linked in with mobile telephony services.

Essentially, the WAP infrastructure will include the establishment of a WAP server interconnected with the WAP development network and a WAP gateway directly linked to each of the network nodes and mobile operator's networks. A base of demonstration sites will be established at each network node within the corporate network(s) of the participating organisations.

3. A Proposal for a National WAP Test-bed in Australia

What is currently proposed for Australian Federal Government funding through the Research Infrastructure Equipment and Facilities (RIEF) Scheme, is the development of a nationally focused integrated research in m-telematics infrastructure, incorporating a wireless internet (WAP) test-bed. The infrastructure will be supported

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by two participating universities: the University of Wollongong, and the University of New South Wales (UNSW), who have between them the largest concentration of healthcare IT researchers in Australia. The project will also be supported by many other organisations such as State and Federal Health Departments, the General Practice Computer Group (GPCG), the National Heart Foundation, the Australian Association for Exercise and Sport Science, a number of Area Health Services and Divisions of General Practice, and the Centre for Behavioural research in cancer and other affiliated groups. The researchers will also be working with a strong network of industry partners. health information system developers and other Australian collaborative e-health projects, including in m-telematics application design and testing, auto patient identification (auto-ID), and healthcare network security [4].

The two universities are already collaborating in a number of nationally significant e-health research and development projects and WAP is just one of several new opportunities to influence the development and direction of future healthcare systems in Australia. The proposed project will complement and align with other projects in the area of electronic patient records over the web in a distributed database environment, WAP and intelligent wireless networks and the application of machine learning and medical artificial intelligence in the collection, interpretation and analysis of medical data.

4. WAP Test-bed Project Goals

The aim of the WAP test-bed is to support collaborative research and to participate in the provision of m-telematics applications to serve the needs of all Australians, including rural and remote communities. The joint WAP project will focus on the following areas:

i. The design, test and development of an open architecture for WEB enabled distributed networks linking general practice, hospitals and homes;
ii. The design, test and development of a home telecare demonstrator facility;
iii. The establishment of a wireless internet (WAP) test bed for supporting m-telematics communications services; and,
iv. The development of a primary and secondary prevention program through interactive WAP-based health communication.

The network will be supported by a high performance secure database server with large capacity storage and backup facilities to permit the development of a new communications environment using WAP and wireless technologies to provide a seamless interface between all major providers of healthcare in the community.

The home telecare demonstrator facility will draw heavily on the IT infrastructure provided by the WEB enabled distributed network listed as a primary objective of this application. A facility will be established initially at the University of New South Wales, for the evaluation, testing and integration of home telecare modalities and initially targeting the elderly frail living alone and the management of chronic diseases in the home such as congestive heart failure and obstructive lung disease. The facility will provide the nucleus for full-scale technical and clinical trials to evaluate patient compliance and acceptance of home telecare technology and to determine healthcare outcomes and cost effectiveness of the intervention.

The first stage will involve the development and testing of a WEB based distributed network linking a limited number of GPs and homes. This will include an extensive evaluation of alternative methodologies for ensuring the confidentiality, security and integrity of patient data. The second stage will be focused on the establishment of the home telecare demonstrator facility to evaluate and integrate the core technologies for home telecare. The third stage will involve the development of WEB based IT infrastructure for collection of data from the patient at home, and the synchronisation and replication of local databases with a central server acting as a data repository.

The fourth stage will involve the development of automated data processing facilities using state of the art expert systems and machine learning algorithms such as See5 / C5.0 for constructing classifiers in the form of decision trees and rulesets. Cubist will be used for producing rule-based models for numerical prediction and Magnum Opus will be used to find associations and interrelationships among attributes.

Further stages will involve the development of education modules for self-management and behavioural change that can be personalised and flexibly delivered to a wide range of patients to target the monitoring of physical activity, smoking habits, and eating habits for weight control. User interfaces that are intuitive and easy to use will also need to be developed.

5. Open Architecture WEB Enabled Distributed Network

The design, test and development of an open architecture for WEB enabled distributed networks linking general practice, hospitals and homes is one of the main objectives of the project. This will involve data collection from a number of devices and locations.

Data collected from monitoring devices and health status assessment instruments in the home for example can provide valuable diagnostic information at the point of clinical contact. Ambulatory monitoring devices can provide real-time data on relevant biological and behavioural parameters. Data from easily worn accelerometers would enable detailed assessment of the physical activity patterns of diabetic patients at home. Physical activity data can be a crucial factor in diabetic control and fine grained activity adherence data, along with the capacity to access its impact on diabetic and other crucial cardiovascular risk parameters.

The electronic patient information folder (PIF) which handles standard medical images, clinical records such as electrocardiograms (ECGs) and other multi-media data objects and text records is already being developed. A key element of the PIF design is the incorporation of a DICOM 3 compliant interface, which permits it to handle image formats produced by virtually all modern medical imaging systems. A future development for PIF will be the incorporation of object-oriented standards such as CORBAmed that is actively creating interoperable specifications for distributed object services (eg. Patient Identification Service, Lexison Query Services, Clinical Observations Access Services etc). Similarly HL7, which is a data messaging standard for the exchange of healthcare information will be a key area of implementation and research.

Bluetooth will be a key element in virtually all m-telecare projects using WAP infrastructure as an open standard for short-range cable replacement radio technology. Bluetooth was jointly developed by Ericsson, Intel, IBM, Toshiba and Nokia. More than 1371 companies worldwide now belong to the Special Interest Group and have signed adopters' agreements. It is now estimated that by 2004-5, Bluetooth wireless technologies will be an in-built feature of more than 670 products (Cahners In-Stat Group).

Bluetooth enables wireless voice and data communications between mobile appliances such as mobile phones and laptop computers, and between mobile and fixed appliances such as digital cameras and printers. Bluetooth is a compact and cost effective technology with standardised communications technology so that Bluetooth modules can communicate with other Bluetooth modules anywhere in the world. A device equipped with a Bluetooth radio establishes connection to another Bluetooth radio as soon as it comes into range.

Since Bluetooth supports point-to-point and point-to-multipoint connections several piconets can potentially be established and linked together ad hoc. Because of these features and its flexibility, Bluetooth will be a key element in virtually all m-telecare projects in the future and a key enabler for some new applications using WAP infrastructure.

6. Home Telecare Demonstrator Facility

Home telecare can be broadly defined as the use of information, communications, measurement and monitoring technologies to evaluate health status and deliver healthcare services to the home from a distance [5].

In 1999 the National Science Foundation (NSF) and the Food and Drug Administration (FDA) convened a Workshop on Home Care Technologies for the 21st Century. They concluded that: "Large scale demographic, economic and technological developments are converging to intensify a gathering momentum toward new home- and self-care technologies and systems" [6]. The Workshop recommendations included the need to provide more support for research to develop practical intelligent tools for processing large amounts of health data and greater use of large-scale demonstration projects for home- and self-care technologies.

A recent report from the FDA also specifically identifies home- and self-care as one of the primary developments projected to dominate the evolving medical-device landscape over the next decade, and the Whitaker Foundation and the National Institute for Disability have both identified home healthcare technologies as a high priority area. The home telecare market in the USA alone is presently between US$12-20 billion and is expected to reach US$66 billion by 2003. Although pressures for efficiency in healthcare delivery are major motivators for rapid development of home- and self-care products in the USA [7], the move towards telecare in Europe and in the UK [8] appears to be being driven by acceptance that national health services have a responsibility to manage the needs of an aging population despite a declining work force.

7. What are the Benefits and Barriers for Australian GPs?

The main benefits that can be derived from WAP and Bluetooth together will be the development of the 'smart home'. Intelligent systems for remote monitoring and support of health status at home to ensure that a patient is well. For example, movements about the house, opening the fridge, toilet use, and house temperature could all be indications of patient status. Another benefit is m-telemonitoring of specific disease conditions such as remote wiring of ECG signals or blood pressure measurement.

Another benefit as the population ages - and one of the main drivers for adopting WAP in healthcare applications - is that the cost of delivering aged care can be reduced. In Australia [9] those aged 65 and over now represent 12% of our population and will increase to between 24% and 26% by the year 2051. The cost of providing healthcare to the elderly is rapidly increasing. Average healthcare expenditure per person is now $A2,536 but increases to almost tenfold for those aged 75 and over. Thus the increasing cost of providing healthcare services to an aging population and changing patterns of utilisation of hospital resources (viz. a rise in admissions but a fall in the average length of stay) provide a powerful motivation for shifting the focus of care from the hospital to the home using web-based m-telematics technologies and applications.

Notwithstanding these imperatives, there are also a number of barriers to be addressed. Barriers to the adoption of telematics in Australia are well documented [10, 11]. Fundamental to the successful adoption of new communications technologies is the ability to overcome technical, legal, ethical and financial barriers. Another major problem is the slow rate of adoption of new communications technologies. In a 1998 report on attitudes towards information technology in general practice, it was found that only 31% of Australian practices owned a computer [12].

Another problem is related to the disillusionment with WAP applications being reported worldwide in response to the first generation of WAP interface and application developments [13]. While for many WAP applications, content is displayed differently for each browser; there are also several interpretations of WML 1.1. The belated 2G+ mobile network upgrades are not due to go live in Australia until the end of the year and WAP is now not expected to have any presence in the 3G spectrum network, which would primarily serve voice and multimedia rich applications. With the enormous investments in healthcare communications networks, the question of payoffs have also become increasingly important. However, studies of investment returns and user satisfaction are far from conclusive [14]. Additionally, the need for an agreed national approach to ensure that benefits can be derived from the use of an electronic health record and information system will be difficult to implement and achieve. A national approach, whilst difficult to achieve, will be central to our ability to provide a person-centred and continuing health care system [15].

8. Concluding Remarks

Overall, the benefits of a national approach to introducing WAP for m-telematics applications can be summarised as maintaining a thrust for maximising the mobility, flexibility, and efficiencies of a combined effort and enabling the transfer of medical information among physicians and their patients. However, because of the difficulties to be overcome, and because the adoption of technology in Australian practices is slow, the path will be a long road. There is controversy over standards, and controversy over cost effectiveness. The use of WAP in healthcare will require focused investment, and the provision of an integrated set of tools and uniform standards to achieve benefits across all providers Nevertheless, by adopting a national approach involving all of the key stakeholders, costs and risks could be minimised and a much earlier transfer of benefits will result.

In this context, it is widely agreed that m-telecare will have increasing relevance and importance as the population continues to age [16]. Furthermore, the use of mobile telecommunications infrastructure in health care will continue to expand rapidly as a means of supporting a more flexible and integrated health care communications network.

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Back to top of page **Back to the sessions page**

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Go to proceeding page **Back to the sessions page**

Country / Region

Monday, 15 January 2001
1400–1530

M.2.3 Explore Opportunities in China Telecom/Data Market

(Webcast, Sponsored by Compaq)

Location: Tapa II

Chair: TAO YUN, Managing Director, Q-east, *People's Republic of China*

M.2.3.1 Towards 3G Mobile Communication in China (ABSTRACT)

QILIANG ZHU, Director General, BUPT Telecom R&D Center, *People's Republic of China*

M.2.3.2

Michelle Chan, Captial Networks Co. Ltd., *People's Republic of China*

M.2.3.3 Current Status and Development of Satellite Communication in China (ABSTRACT)

GUXING HUANG, CEO and QILIN XIE, VP, Guangdong South Satellite Telecommunication Service Co., *People's Republic of China*

M.2.3.4 Challenge from competitive telecom companies in China

JAY HU, Vice President, Strategic Advisory Services, Xin De Telecom International Venture Co., Ltd,
People's Republic of China

Towards 3G Mobile Communication in China

Qiliang Zhu

Abstract

1. Booming Market

During the period of recent 20 years the total number of the telephone subscribers (including that of fixed and mobile communication) in China increased from 2 million in 1979 to 10 million in 1992. It took 13 years to reach this stage. Later, it took another 6 years to expend the fixed and mobile telephone subscribers from 10 million to 100 million in 1998. The further increasing from 100 million to 210 million by the end of October 2000 took only 2 years. At present the telephone penetration for fixed and mobile communication in China reached 17.8% and 5.1% respectively.

The China's mobile communication market is developing with unprecedented speed. The capacity of mobile communication network ranks the second in the world. By year end of 1999 the mobile subscribers reached 43 millions and increased to more than 67.23 millions by the end of October 2000.

	1999 (achieved)			2000 (plan)	
	China Mobile		China Unicom	China Mobile	China Unicom
Volume of business revenue	Analogue	GSM	GSM	12,506 million	3,458 million
Nbr. of subscribers (million)	5.51	33.08	5.21	60 million (5 million prepaid) Δ+=20 million	13 million Δ=8.4 million
Nbr. of redio channels				3.44 million Δ=1.2 million	1.03 million
Coverage	1440 cities at prefectural	•2038 cities at prefectural level ·81 operators in 48 countries	200 cities at prefectural	110 operators in 65 countries	313 cities at prefectural
Quality of service	NAR: 52.5% CDR: 3%	CTR: for incoming long distance call 58.9% CTR: for radio traffic channel 97.5% CDR: 2%		CTR: for incoming long distance call 53% CTR: for radio traffic channel 97%	

CTR: Connect-Through Rate NAR: Network Access Rate CDR: Call Drop Rate

Table1. Original Plan of Mobile Communication Development for Y2K

It is projected that there will be 130 millions mobile subscribers in 2003. This number will be increased to more than 180 million and 300 million in year 2005 and 2010 respectively (see fig.1).

The booming mobile market is definitely attracting and will continue to attract various domestic and foreign equipment manufactures, sevice providers and content providers to invest heavily in China's mobile communication industry

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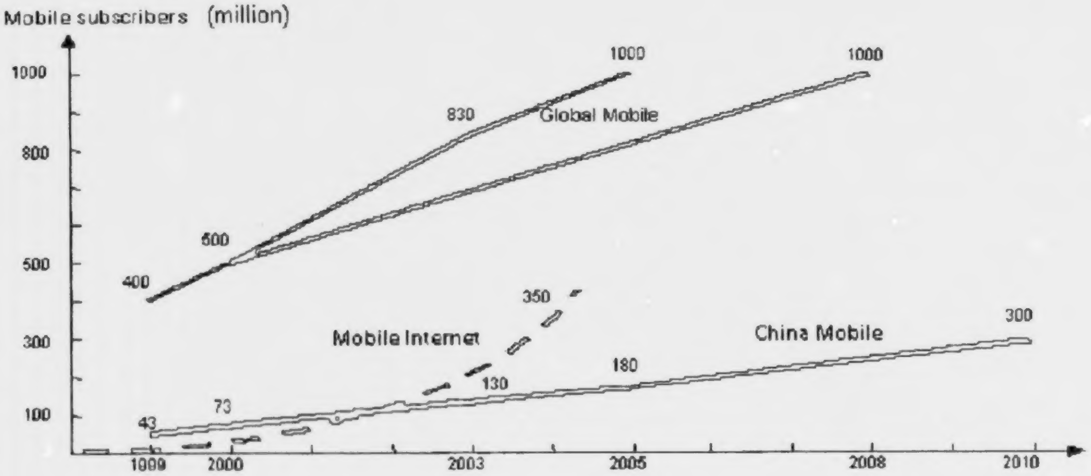


Fig1. Market Growth

Fig1. Shows also the growth of global mobile users. China will have more and more market share in the global mobile communication area in the period of 2000-2005. On the other hand, the number of Internet user in China is also tremendous increased. It reached 8.9 million with 3.5 million PCs connected to Internet by end of 1999 and 20 million in year 2000. The global Internet users were 260 million, where 37 million users access the Internet everyday, browsing the information from 830 million web pages per day. It is projected that the China's mobile internet subscriber will be increased from 1.4 million in 2000 to 34 million in 2004.

At present the entities providing the value-added telecom and infromation services are growing fast. There were 300 ISPs and 1000 ICPs in China by end of 1999. The number of WWW nodes has already exceeded 15 thousand. The bandwidth for international access was 351 MHZ in 1999 and will expended to more than 1000 MHZ in year 2000.

2. Radio Interface Standards

Apart from the ITU, all national and regional standardization organizations are actively involved in the IMT-2000 standardization. Besides, their separate involvement has evolved into conglomeration of two multi-regional standardization organizations:

- 3GPP (3G partnership project), consisting of 6 standardization organizations: European ETSI, American T1, Japanese ARIB and TTC, Korean TTA and Chinese CWTS. The aim is to formulate the standard for radio interface WCDMA and CDMA TDD (which is the harmonization of TD-SCDMA and UTRA TDD) used to access the GSM core network.
- 3GPP2, comprising 5 standardization organizations: America ANSI (TIA), Japanese ARIB/TTC, Korean TTA and Chinese CWTS. The goal is to formulate the standard for radio interface cdma2000 used to access the ANSI/IS-41 core network.

IMT-2000 radio terrestrial interface specification (IMT.RSPC) was adopted at 18th meeting of ITU-R TG8/1 in November 1999. It includes the following 5 standards (see table 2):

ITU-T defined	Proposal submitted	Partner
IMT-2000 CDMA DS (IMT-	WCD	3GPP: WCDMA (DS) 3GPP2: cdma2000 (DS)
IMT-2000 CDMA MC (IMT-	Cdma2000	3GPP2: cdma2000 (MC-1X, 3X, 6X, 9X,12X)
IMT-2000 CDMA TDD	TD-SCDMA UTRA TDD (TD-CDMA)	CWTS 3GPP: L2 & L3
IMT-2000 TDMA SC (IMT-	UWC-136/EGDE	ETSI/VWC
IMT-2000 TDMA/FDMA	DECT	EUROPE

Table 2. IMT-2000 Radio Interface Standard (IMT.RSPC)

A. CDMA Technology:

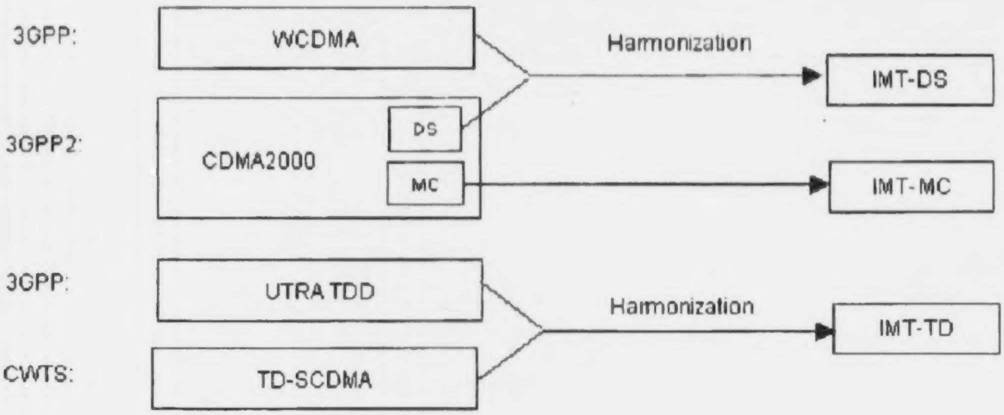
- IMT-2000 CDMA DS based on WCDMA
- IMT-2000 CDMA MC based on cdma 2000
- IMT-2000 CDMA TDD based on TD-SCDMA and UTRA TDD

B. TDMA Technology:

- IMT-2000 TDMA SC corresponding to UWC-136/EGDE
- IMT-2000 FDMA/TDMA corresponding to DECT

As can be seen from fig.2, the harmonization activities resulted in a single third-generation CDMA standard with three modes:

- a direct-spread mode based on WCDMA
- a multi-carrier mode based on cdma2000
- a IMT-TD mode based on UTRA TDD and TD-SCDMA plus one third-generation TDMA standard.



* GPP: 3G Partnership Project

CWTS: China Wireless Telecom Standard

Fig 2. Harmonization of Standards

1) The direct-spread CDMA mode must be based on WCDMA with some minor modifications to the existing specified 3GPP for EDGE/UWC-136.

- The WCDMA standard must include hooks that make it possible to connect WCDMA with ANSI-41-based networks.

2) The multicarrier mode must be based on the multicarrier cdma2000 mode (specified by 3GPP2)

- The multicarrier cdma2000 specification must also include hooks that make it possible to connect multicarrier cdma2000 to GSM-base netowrks.

3) The TDD mode must be based on the UTRA TDD mode-work is currently under way to harmonize the UTRA TDD mode with the Chinese TD-SCDMA system.

- The TDD specifications must allow for connections to GSM- and ANSI-41-based networks.
- IMT-DS is the harmonization of direct spread spectrum part of 3GPP's WCDMA techynique and 3GPPE's cdma2000 technique. It is still called WCDMA.
- IMT-MC is cdma2000, keeping only the MC modes: 1X, 3X, 9X, etc.
- IMT-TD actually includes low chip rate TD-SCDMA and high chip rate UTRA TDD techniques. They have been integrated in terms of chip rate of 3.84 Mcps and 1.28 Mcps (1/3 of 3.84 Mcps).

As indicated in fig.3, at the physical layer UTRA TDD and TD-SCDMA are completely separated, based on two different specification of 3GPP and CWTS (China Wireless Telecommunication Standard).

The layer 2 and 3 are basically identical, using 3GPP technical specifications.

Because the CDMA TDD is mainly developed in 3GPP, and the technical specifications of the 2nd and the 3rd layer protocols are suitable only for the GSM-MAP based core network, it should be operated in IS-41 core network too.

Currently UTRA TDD and TD-SCDMA are being harmonized into one standard. The work on defining the hook and EXTENSION in layer L2 and L3 for further harmonization has planned come to its total completion by 2000.

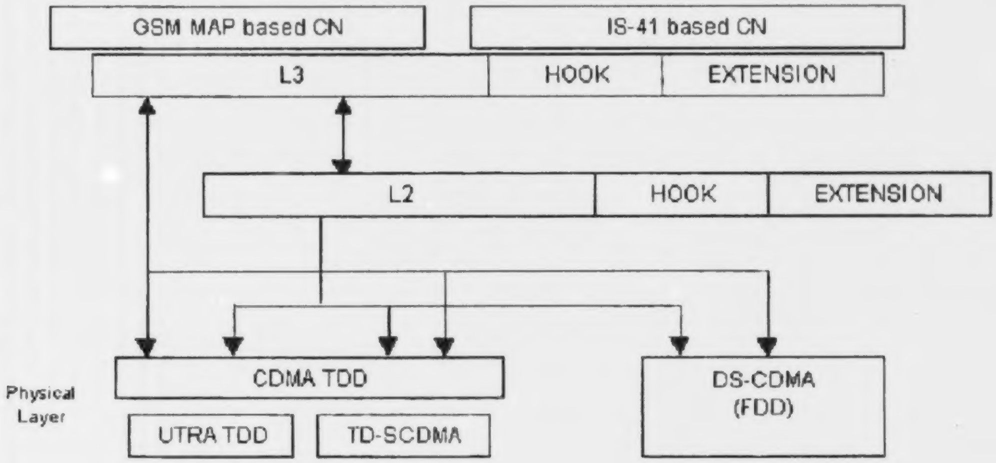


Fig 3. Harmonization of TD-SCDMA with UTRA TDD

The main specifications and features comparison of 2 physical layers standards for CDMA TDD (UTRA TDD and TD-SCDMA) shows that TDMA achieved high performance and low cost (i.e. high spectrum efficiency) because it adopts the following techniques:

- Smart antenna. It can extremely reduce the multipath interference, increase the system capacity and reception sensitivity, lower the transmission power and the cost of base station;
- Up-link synchronization. It can simplify the H/W of base station and lower the cost of base station;

- Software radio. To realize baseband digital signal processing (such as smart antenna and multiuser detection, is the key to this system to flexibly use new techniques. It also can reduce the product development cycle and cost.

In the process of formulating the standard of 3G mobile high attention was paid internationally for the first time to the TDD mode, and TDD standard is developed both in CDMA and TDMA systems. It is mainly because that under the same requirement of IMT-2000, TDD system has the advantages as follows:

- TDD can use various frequency resources and has no need for pair frequencies.
- TDD is suitable for asymmetric transmission rate up and down links, especially for IP type data services.
- TDD works at the same frequency for the up and down link transmission. It's convenient for TDD to use the advanced technologies, such as synchronous CDMA (SCDMA), smart antenna, etc. because of the characteristics of its symmetrical radio ware propagation. So the goal of improving the performance and reducing the cost can be achieved.
- The cost of TDD system equipment is relatively low. It will be 20-50% cheaper than that for FDD.

The major problem of TDD system is on the side of moving speed of UE and coverage area:

- ITU requires that the UE in TDD system should move at the speed of 120km/h, while FDD system should reach 500km/h.
- The cell radius of TDD system is only several kilometers, while that of FDD system is possibly several ten of kilometers.

Conclusion: It is predicted that the future prospect of the 3G mobile will be a common network:

- Satellite mobile communication system is used for the seamless coverage.
- FDD system is used for construction national and international mobile communication network.
- TDD system is used for providing high density and high capacity of voice, data and multimedia services in the urban population-concentrated areas.
- Dual-mode, even multi-mode user terminals are used for global roaming.

3. Evolution of Core Networks

The radio interface standard has been basically determined, but most of standards of the core network need to be completed by year 2000 from the view point of core networks, the evolution line is based on the two core networks of second generation: GSM MSP and ANSI-41. In general, there are two major evolution lines indicated as A and B in fig.4:

A. GSM MAP + WCDMA/CDMA TDD

- 3GPP will formulate the standards
- standard for radio interface is completed in 1999 and that of network part should be finalized by year 2000.
- GSM operators and Japan NTT DoCoMO will proceed along this line.

B. ANSI-41 +cdma2000

- 3GPP2 will formulate the standards
- Standard for radio interface is completed in 1999 and that for network should be finalized by 2000.
- CdmaOne operators, and particularly those which provide cdma2000 services using the same bands as for CdmaONe, are interested in this evolution line.

3G standards also enable radio interface and core network to be mutually independent. That means all radio-access network modes with standard interface must be able to flexibly connect to the different type of core networks. That why we have two additional evolution lines.

C. ANSI-41 + WCDMA / CDMA TDD

- The relevant content should be added to the part of WCDMA wireless access network to insure the compatibility with ANSI-41 core network.
- The formulation of this part is presently subject to 3GPP in coordination with 3GPP2. The part of hooks is completed in 1999 and the protocol extension by Q1 2000.
- Operators in Korea are interested in this line.

D. GSM MAP + cdma2000

- The relevant content should be added to the part of cdma2000 wireless access network to insure the compatibility with GSM MAP core network.
- It is to be formulated by 3GPP2 in coordination with 3GPP.
- The "HOOKS" part is planned to be completed by early 2000 and the "protocol extension" by mid 2000.

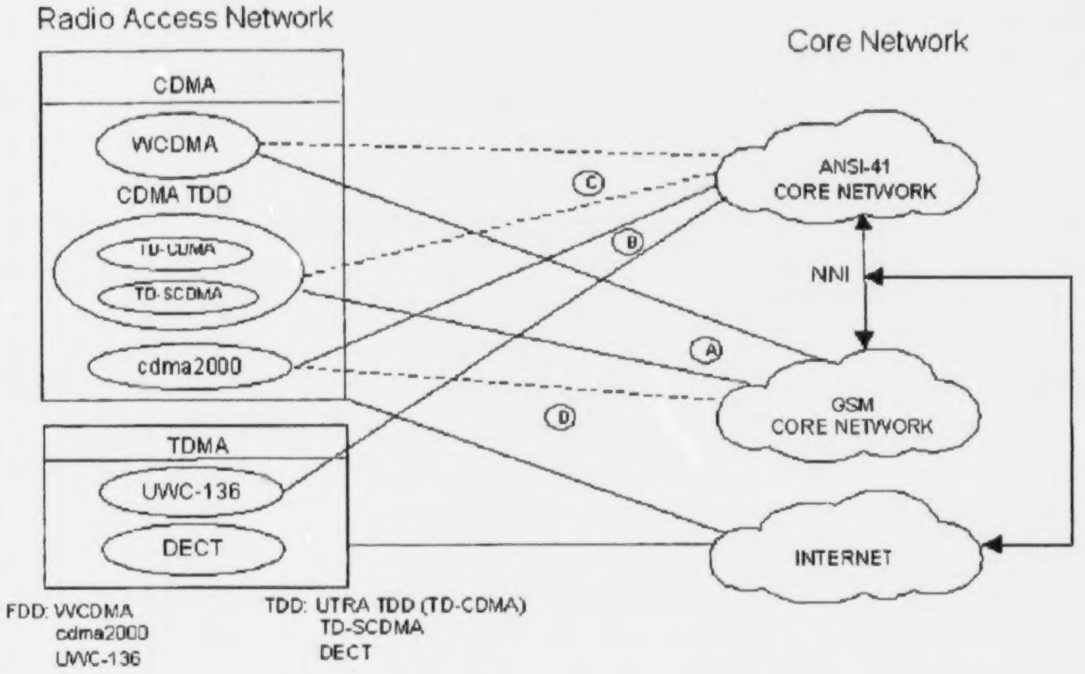

Radio Access Network
Core Network
CDMA
WCDMA
CDMA TDD
TD-CDMA
TD-SCDMA
cdma2000
TDMA
UWC-136
DECT
ANSI-41
CORE NETWORK
NNI
GSM
CORE NETWORK
INTERNET
Ⓐ
Ⓑ
Ⓒ
Ⓓ
FDD: WCDMA
cdma2000
UWC-136
TDD: UTRA TDD (TD-CDMA)
TD-SCDMA
DECT

Fig4. IMT-2000 3G Family Standards

Just like GSM and CDMA technologies, IMT-2000 keeps evolving to enhance the service capability and performance. The ITU-R Study Group 8 meeting held in Geneva from November 11-12 decided to form a new permanent working party (WP 8F) to continue the study of IMT-2000, and also set up an IMT-2000 study group to intensify the further study.

Y2K was the critical year for 3GPP and 3GPP2. Competing FDD harmonized standard, they attempted to accomplish TDD harmonization and a complete set of network standards.

4. The Evolution Process

One of the possible way of evoluting 2G mobile communication network to 3G is presented below.

Phase 1: Providing 3G mobile services in 2G network

In the existing GSM network, while expanding its capacity, the extended BSC(E-BSC) will be introduced and the TD-SCDMA base station will be added at the same location of existing GSM base stations in the user-concentrated area as shown in fig5.

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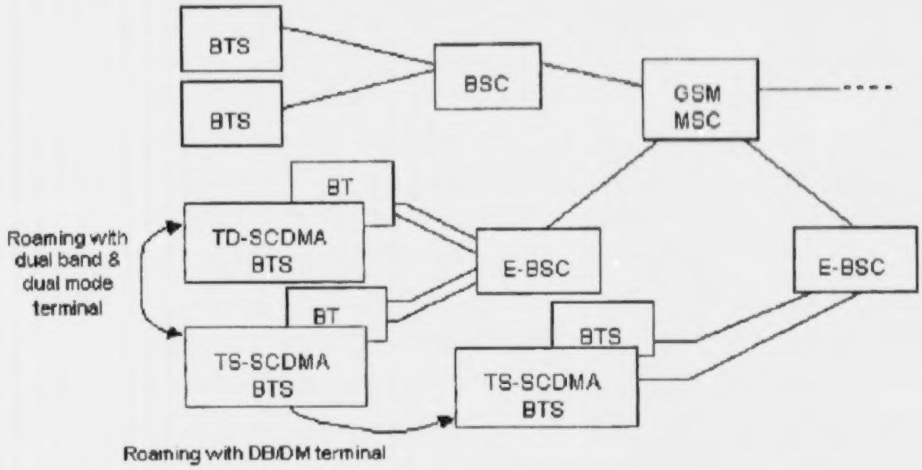
BTS
BTS
BSC
GSM MSC
BT
TD-SCDMA BTS
Roaming with dual band & dual mode terminal
E-BSC
E-BSC
BT
BTS
TS-SCDMA BTS
TS-SCDMA BTS
Roaming with DB/DM terminal

Fig5. Phase 1 of evolution

The user terminal should work in dual band and dual mode. The preliminary 3G users may get the 3G services within the coverage of TD-SCDMA base stations and use the GSM outside of the coverage. The handover can only be realized among TD-SCDMA base stations connected to the same E-BSC without impacting on the GSM functions.

The required investment in such situation is lower than that of normal capacity extension of GSM system. The average cost of BTS and BSC equipment undertaken by each user will be 20-30% lower than that of GSM system.

In this way, not only the capacity is extend, but also 3G mobile communication services can be provide for users in high-density user areas, solving the capacity issue caused by shortage of frequency resources. This enables 3G system to be smoothly deployed first in the big cities. The handover between different TD-SCDMA BTSs connected to the different E-BSCs is available, but the automatic roaming is still based on the GSM network. In this phase the national and international coverage for 3G is not yet realized.

The above evolution step is also suitable for 2G CDMA system (IS-95 standard) to meet the demand on voice and data services for high-density users.

Phase 2: Migrating to 3G mobile communication network

In the period of 2004-2005 the 3G mobile communication will be developed with high-speed growth, starting the construction of entire 3G network (Fig6).

In phase 2 the only equipment replacement is to change E-BSC to 3G BNC plus 3G MSC. The BTS which is the major part of the capital investment has already been constructed in phased 1 and it's necessary for software upgrading for its interface. Besides, in 3G network there are not only TDD base stations, but also FDD base stations.

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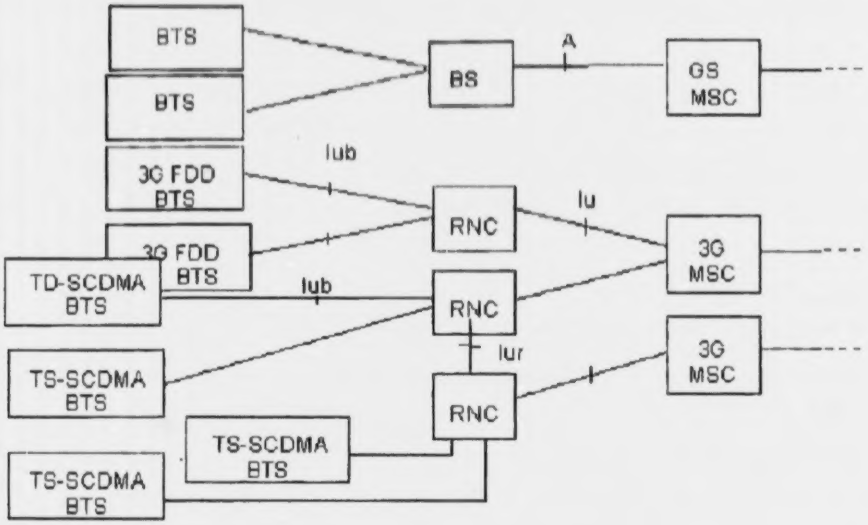
BTS
BTS
BS
A
GS MSC
Iub
3G FDD BTS
3G FDD BTS
RNC
Iu
3G MSC
TD-SCDMA BTS
Iub
RNC
Iur
3G MSC
TS-SCDMA BTS
RNC
TS-SCDMA BTS
TS-SCDMA BTS

Fig6. Phase 2 of Evolution

This 3G network will cover the whole China and realize the international roaming. The intermediate phase between 2G and 3G mobile systems is 2.5G system: GPRS. It can also be considered as phase 1 of 3G system by 3GPP. The architecture is shown in fig. 7:

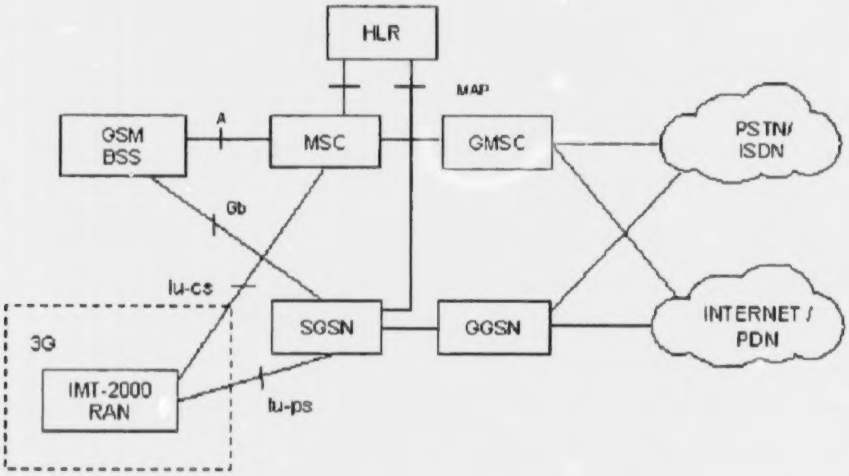
HLR
MAP
GSM BSS
A
MSC
GMSC
PSTN/ ISDN
Gb
Iu-cs
3G
SGSN
GGSN
INTERNET / PDN
IMT-2000 RAN
Iu-ps

Fig7. 3GPP: Phase1 of 3G system Architecture

The GPRS vendor equipment is listed in table 3.:

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	trial	Released		Prototype	Released
Alcatel	Jul. 1999	the end of 1999 - Jan. 2000	Alcatel	Q2 2000	
Ericsson	1st version: Q3 1999 2nd version: Mar.-Apr. 2000	Jun.-Jul. 2000	Ericsson	Q4 1999	2000
Motorola	First half of 1999	Q1 1999	Motorola	Q3 1999	Q2 2000
Nokia		Network: 2nd half of 1999 Wireless: Apr. 2000	Nokia		Q4 2000
Nortel	Q4 1999	Apr. 2000	Siemens	Q1 2000	2nd half of 2000
Siemens		Mar. 2000	SAGEM	Jul. 1999	Q1 2000
Huawei	Mar. 2000	Jun. 2000			
Datang	Mar. 2000	Jun. 2000			
Zhongxing					

Table 3. GPRS Vendor Equipment

5. Issue on Spectrum Allocation

In 1992 on the WARC-92 (World Administration Radio Communication Conference) the ITU-R allocated the band with of 230MHZ in 1885-2025MHZ for IMT-2000 use, including 1980-2010MHZ and 2170-2200MHZ for satellite communications. Thereafter the WARC-95 made some adjustment, and satellite bands for North American and Caribbean region are expended to 1980-2025MHZ and 2160-2200MHZ. Fig- shows the 2GHZ band allocation by ITU, Europe, USA, China and Japan.

- US: FCC has auctioned most parts of 1.9GHZ band (1865-1900MHZ) to PCs service several years ago. American-allocated frequencies for IMT-2000 seriously differ from the ITU allocation, which bring the problem on international roaming.
- European and Japanese frequency allocation rather tallies with WARC'92 s allocation.
- China:
    - In 800MHZ frequency band there are totally 90MHZ spectrum allocated for China Mobile, China Unicom, army and GSM further extension. (see fig.8)

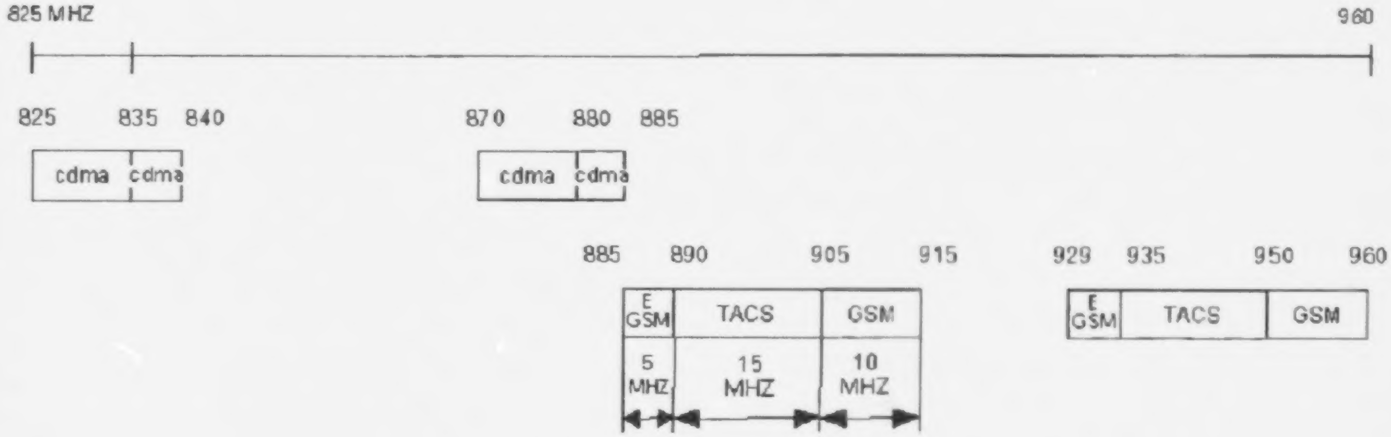

Fig8. Spectrum Allocation in 800-900 MHZ Band

- In 1.9GHZ frequency Band 90MHZ bandwidth was allocated, where 60MHZ (1805-1865MHZ) for TDMA and 2x15MHZ (1865-1880 and 1945-1960MHZ) for CDMA and PCs. Besides. 2x20MHZ frequency band (1880-1900, 1960-1970) was originally planned for FDD WLL use, Recently MII require to stop of examining and approving the use of these frequencies for that prupose, thus setting apart enough frequencies for IMT-2000.

- Following Tab4. Indicates the spectrum requirement for IMT-2000 in China:

	2005	2010	2015
Terrestrial Mobile Communication	318 (MHZ)	510	618
Global Satellite Mobile Communication	44.2 (MHZ)	86.2	--

Table 4. China's Spectrum Requirement for IMT2000

6 Conclusion

A. For evolution to 3G system based on GSM network, the evolution strategy should insure to eliminate the risk of setting up new core network and high investment.

- The first step of installing TD-SCDMA system: only setting up TD-SCDMA base station in hot spots based on GSM network with 3G spectrum. TD-SCDMA BTS connected to BSC of GSM via Abis. Avoid support voice service without changing of GSM network while supporting data service (up to 384 kbps) via SGSN.
- The second step: during the coexistence of GSM and 3G core network, TD-SCDMA/BTS will be in addition connected to 3G core network via RNC.
- The third step: upgrade to complete 3G based network.

B. To introducing the 3G mobile system in China, the operator should consider the following:

- standardization & harmonization
    - support ITU to make IMT-2000 standards
    - initiate & actively involve in HOG
    - promote the harmonization of IMT-2000 CDMA DS/MC and IMT-2000 CDMA TDD
- service
    - develop new service and applications, begin with 2G network, to activate market and to lay a solid foundation for 3G broadband, multimedia and high speed data services
- operation
    - introduce trials of 3G system in time & prepare for commercial use
    - study on radio network planning as early as possible
    - study on new requirement of supporting network system to suit the introduction of 3G services & systems
- resources & service license
    - predict the 3G market needs and research the demand of spectrum
    - apply in time for China government for licensing 3G operation

Back to top of page **Back to the sessions page**

Prof

Zhu Qiliang

Beijing University of Posts & Telecommunications

On graduating from Moscow Institute of Telecommunications, Zhu Qiliang joined Beijing University of Posts and Telecommunications (BUPT). From 1984 to 1987 he worked in Engineering Department of ALCATEL BELL in Antwerp, Belgium to participate in the telecom software design and testing.

Professor Zhu lectured widely on Telecommunications and Computer Software. Being a member of IEEE, his major research work is directed to the switching system and wireless communication. At present, Mr. Zhu is the professor of Beijing University of Posts & Telecommunications (BUPT) and the Deputy General Director of BUPT Telecom R&D Center. In addition, He is awarded the Special Government Allowance donated by the State Council since 1990.

In 1996, he honorably received the World Lifetime Achievement Award for management leadership by American Biographical Institute, Inc.

Back to proceeding page **Back to the sessions page**

Abstract

The authors summarize the current status of the private satellite communication network owned by telecommunication companies. They then address the difficulties of satellite communication development in China, including market segmentation and the high cost of satellite communications. They also make a comparison of satellite communications and fiber cable in China. Next, they present development opportunities in satellite communications in China, such as the advantages of satellite communications for Internet Protocol (IP) and Digital Video Broadcasting (DVB). They observe that the Internet also provides new opportunities in satellite communications, as does mobile satellite communications. They conclude with a description of cooperation and development with the SST project which includes:

- Satellite IPLC cooperation
- Content exchange
- CHINANET/INTERNET access
- International long-distance education cooperation and
- Cooperation for mobile satellite communications in the Asia-Pacific area.

Go to proceeding page   Back to the sessions page

CURRENT STATUS AND DEVELOPMENT OF SATELLITE COMMUNICATION IN CHINA

Guangyu Wang

Abstract

1. APPLIANCE OF SATELLITE COMMUNICATION IN CHINA
    1.1 Current status of satellite communication network owned by telecom companies
    1.2 Current status of private satellite communication network
    1.3 Current status of companies focus in satellite communication

2. DIFFICULTIES OF SATELLITE COMMUNICATION'S DEVELOPMENT IN CHINA
    2.1 Market segmentation of satellite communication
    2.2 High cost of satellite communication
    2.3 Comparison of satellite communication and fiber cable in China

3. DEVELOPMENT OPPORTUNITIES OF SATELLITE COMMUNICATION IN CHINA
    3.1 IP/DVB technology with advantages of satellite communication
    3.2 New opportunities that Internet brought us
    3.3 Development opportunities of satellite mobile communication in China

4. COOPERATION AND DEVELOPMENT PROJECT OF SST
    4.1 Satellite IPLC cooperation
    4.2 Content exchange
    4.3 CHINANET/INTERNET access
    4.4 International long-distance education cooperation
    4.5 Cooperation of satellite mobile communication in Asia-Pacific area

Program

@ Technology

Monday, 15 January 2001
1400–1530

M.2.4 New Satellite Initiatives

Chair: TIMOTHY LOGUE, Space & Telecom Policy Analyst, Coudert Brothers, *USA*

M.2.4.1 Satellites: The "Extra-Terrestrial" Advantage (ABSTRACT)

KENG-JIN LIAN, Senior Engineer, Hughes Network Systems, *USA*

M.2.4.2 Wide-area Technologies and Services in the Trans-Pacific High Data Rate (HDR) Satellite Communications Experiments (ABSTRACT)

EDDIE HSU & CHAW HUNG, Jet Propulsion Laboratory, California Institute of Technology, *USA*

PATRICK SHOPBELL, GRETCHEN WALKER & DENNIS WELLWITZ, California Institute of Technology and University of Maryland, *USA*

GILBERT CLARK & MAKOTO YOSHIKAWA, Mt. Wilson Institute and Institute of Space & Astronautical Science, *Japan*

RICHARD DESJARDINS, National Aeronautics & Space Administration, NASA Research & Education Network, *USA*

NAOTO KADOWAKI, NAOKO YOSHIMURA & TAKASHI TAKAHASHI, Communications Research Laboratory, Ministry of Posts & Telecommunications, *Japan*

PAT GARY, National Aeronautics & Space Administration, Goddard Space Flight Center, *USA*

MIKE GILL & HARUYUKI TATSUMI, National Library of Science and Sapporo Medical University, *Japan*

M.2.4.3 Satellite Internet: Technical Advancement and Business Scope (ABSTRACT)

SHUICHI YOSHINO, Sub Manager and YOSHITSUGU YASUI, Senior Manager, Media Technology Factory, NTT Communications Corporation, *Japan*

M.2.4.4 Waveform Advances for Satellite Data Communications (ABSTRACT)

JOHN M. PUETZ, President, MasterWorks Communications and MARK DANKBERG, Chairman, President & CEO, ViaSat Inc., *USA*

Satellites: The "Extra-Terrestrial" Advantage

Keng-Jin Lian

Abstract

www.hns.com

Introduction

The demand of new applications often drives advancements in hardware capabilities. The same is true for network solutions, where customers are demanding improved access to information for competitive advantage, increased productivity and decreased costs. Many of today's emerging applications, from live video to Web page delivery, represent heavy outbound bandwidth requirements and relatively light, if any, inbound requirements.

Market Trends

There is an inherent flaw with the Internet. As the new e-commerce economy fuels the growth of the Internet, conventional terrestrial means of delivering and distributing content efficiently is becoming a major problem.

The Internet was originally used for email and file transfers, which are point-to-point nature applications. However, increasing amount of Internet traffic is of a broadcast nature, as data from one source is being transmitted to multiple sites. One example is the online Victoria's Secret fashion show that had been advertised during the Super Bowl in 1999. During the live webcast, only 40% of the millions of Net users got through. The reason is due in part to the congestion on the Internet, resulting in jittery video quality. Another similar incident occurred during President Clinton's videotape deposition in the summer of 1999. A huge number of potential viewers were unsuccessful in obtaining the data when the server system collapsed.

In recent years, there has been a rapid and dramatic shift in the business world toward Internet, Intranet, and World Wide Web (WWW)-based services and applications. Most of these services are available using standard (usually no-cost) Web browser-based clients, and low-cost server software. A salient feature of this new paradigm is that the services are highly asymmetric. That is, Internet traffic coming from the origin servers is usually at a ratio of 4:1 compared to requests originating from end users. Most content or data resides at the origin servers, as users request the content, content is then being transmitted to the end user location. During the content transmission process, small acknowledgements will be transmitted back to the origin server to confirm receipt of the content and to request for further transmission.

As bandwidth becomes a commodity and as traffic continues to grow, congestion is becoming a major problem for a lot of network and IT professionals. As Internet traffic become increasingly broadcast in nature, is adding more bandwidth the solution? Is laying more cables the solution of the future? There are numerous issues concerning the cost and deployment of these solutions. The cost of adding more bandwidth is extremely expensive, especially for international locations. Adding more bandwidth also just tends to increase performance between the end users and the Points of Presence (POP), but doesn't eliminate the growing traffic congestion on the Internet backbone since it increases demand by end users for more media rich and high bandwidth applications. For these reasons, a more intelligent Internet infrastructure needs to be used to overcome the Internet congestion problem.

Internet Performance Issues

The growth and the popularity of the Internet have far exceeded anyone's expectations. This unprecedented growth has resulted in three types of bottlenecks, a lack of sufficient bandwidth at the "last mile", congestion at the network level which includes public and private networks, and at the backbone level. These bottlenecks have impeded the performance of the Internet.

Good Internet performance is measured by the web site response time. High speed last mile connection between the subscriber and the Internet, and reliable Internet performance between the Web site and the subscriber's connection point can contribute to good Internet performance.

"Last mile"

Most home-based users that access the Internet with analog modems could not transmit data beyond 56 kbps. With the growing availability of broadband Internet connections, such as Digital Subscriber Line (DSL) and cable, the "last mile" problem might be eliminated for certain areas. However, the availability and penetration rates of cable and DSL deployment in many countries are extremely slow in expansion.

Network Level

With the surge in content and richer media typed content, many Internet Service Providers (ISPs) are being overwhelmed at the network level. For a lot of ISPs, the near term solution is to add more bandwidth to add servers to support the Internet requests coming in from millions of the growing Internet users. However, many recognize that the long-term solution is to add bandwidth management tools, caching and load balancing capabilities to support the increase challenges.

Backbone Level

The rapid pace of evolution in e-commerce economy has revealed the Internet architecture's inherent flaw. Since most Internet data are exchanged between networks for free, backbone providers have an incentive to invest in intra-network performance, but not inter-network efficiency. Consequently, data packets are offloaded to other networks in order to minimize network burden on the backbone provider's own network. As data packets travel across peering points, these data packets are usually subjected to other backbone provider's network prioritization scheme. As a result, factors such as proximity to the final destination and prioritization of the other networks' data packet are usually disregarded. Lack of effective agreement between backbone providers and economic settlement results in poor Internet performance and unreliability. According to a study conducted by Dataquest, streaming media that travel through 20 routers (including peering points) experience an average packet loss of 25%. For live (real-time) streaming media applications, loss packets that cannot be re-sent, result in a degradation of quality.

The extraordinary buildout of fiber bandwidth capacity worldwide has had a relatively minimal impact on the public Internet's performance. The Internet is slow due to inherent architectural issues (e.g. data exchange inefficiencies), and simply throwing bandwidth at the problem will not solve the bottlenecks. Public Network Access Points (NAPs) and private peering points are major intersection of the Internet, where large amounts of data converge. Congestion at these intersections often results in data packet loss. Consequently, packets will need to be re-sent; thereby increasing traffic and slowing downloads while decreasing the reliability and quality of data transmissions. According to InterNAP, downloading a file from a web site under conditions with 1 % packet loss can potentially double the amount of time required to complete the download. Unfortunately, the lack of central management and a lack of economic incentive to optimize peering points prevent any single entity from taking any action to overcome these architectural problems associated with the Internet.

Delivering content beyond the edge of the Internet

Hughes Network Systems (HNS) has been designing and implementing a new satellite Internet Infrastructure Service. The motivation for doing so is two folds; the first is the belief that there is a need to overcome the Internet's architectural flaw. The second motivation derives from the belief that there is a trend towards caching and content delivery directly to the end user.

This trend has lead to the placement of commercial services at increasingly closer points to the user starting from NAPs and Super POPs to ISPs and local POPs. Service providers such as Content Delivery Networks (i.e., Akamai, Digital Island, iBeam, and Cidera) have entered into the market to offer services such as edge network caching, content delivery and streaming, that increase efficiencies, lower costs and improve performance of the Internet. The value proposition of these services is based on delivering content as close to the end user as possible. However, these providers can only move the content to the edge of the Internet. It is HNS' belief and philosophy that we can go the extra "last mile" by delivering the content to the end user's digital doorstep.

At the moment, there are three solutions to eliminating the congestion on the Internet. The first is to increase bandwidth to the end user's connection to the Internet - "last mile". The second is to add intelligence to the network to mitigate/overcome congestion and the third is to deliver content to the end user by using an "overlay" network that avoids much of the public Internet as much as possible.

HNS' solution involves the use of a high speed outroute with a combination of smart caching, intelligent bandwidth management and load balancing tools. The Network Operations Center (NOC) will have the ability to aggregate popularly requested content and pushed the content out to the end user sites. This will not only allow the end users to have immediate access to fresh content, it will allow the end user's to bypass the conventional bottlenecks along the Internet.

Why Satellites?

On a global scale, satellite technology will play an important role in how content is being delivered to the mass population of Internet users and providers. There are numerous companies that are focused on delivering high quality, high scale streaming media through the Internet. Companies such as IBeam, Cidera, and Net36 are just some of the prominent players in this arena. As an example, a DirecPC broadband service was responsible for webcasting the Victoria Secret 2000 fashion show and also the "Smashing Pumpkins" concert that took place on July 13, 2000. In addition, according to a report from the Internet News, about 61 percent of large web sites surveyed in the Second Quarter, 2000 contains streaming audio and video content on their websites. As streaming content becomes more popular, the demand for a more efficient transmission method becomes increasingly evident.

Economics

Satellite delivery traditionally offers the advantage of low-cost transmission and delivery to areas that are lightly served (or not served at all) by the terrestrial Internet. As bandwidth-intensive applications proliferate, businesses and consumers have recognized that terrestrial transmission of rich media content is not cost-effective. According to a report by Pioneer Consulting Group, satellite mediacasting is a more cost effective than terrestrial multicasting. The report suggests that the current efficient data rate for sending streaming content is approximately 1-1.5 Mbps. This data rate may not seem very high, but considering the logistics of establishing a 1-1.5 Mbps connection to every end user terrestrially, the cost implications and implementation becomes a major problem. However, satellites will only need to establish a 1-1.5 Mbps uplink and anyone within the coverage area can receive the streaming content.

Businesses which regularly transmit information from a central server to multiple (more than 10) remote locations can deliver streaming video webcasts, business TV, videoconferencing applications and other Intranet content at a fraction of the cost by using the satellite based technology. With satellites, as the number of site increases, the cost of transmission diminishes very significantly.

Overlay

For some companies, Internet traffic is as much as 60% of the WAN traffic, while other email and network traffic takes up another 30 - 35% (*source: Novell*). By implementing a satellite based caching and content delivery service as an overlay to the existing infrastructure, all this Internet traffic can be offloaded the terrestrial Wide Area Network (WAN).

According to a survey conducted by Media Metrix, the average user at work in the U.S. visits 45.4 unique webpages per day, the total minutes spent online came out to 13,910 million minutes in the month of April, 2000. The study also states that on the average, a user spends an average 49.7 minutes a day at work on the Internet. These statistics suggests that the amount of time an employee spent at work can impact the enterprises network performance. If the employee visits an average of 45 unique pages, and assuming that these are the top 45 most popular static web pages on the Internet, the amount of traffic generated per employee per day is at least 12 Mbytes per person. In a corporation with 1000 employees, assuming that 40% of them uses the Internet, at least 4.8 Gbytes (static web pages) of information is being generated. As more websites increasingly add and provide dynamic/streaming media content, the amount of traffic generated can only add to the increasing Internet congestion.

Single Hop

Unlike terrestrial technology, satellite's broadcast nature and wide footprint spans over a large area. As a result, to access content at the edge of the Internet, it's always a single hop away. By implementing smart caching technology, users are able to obtain improved web performance by at least 40% or greater (depending on the characteristic of the website) compared to a regular terrestrial access.

Ubiquitous Coverage

With the Satellite located more than 38,000 km away, the highly concentrated satellite beam, more commonly known as a "*footprint*" is able to cover a large geographic area. Typically, for the Continental U.S., a single satellite beam is usually what is needed. In order to obtain access to the satellite content delivery service, only a small antenna is required. The antenna size can be as low as 66 cm in diameter, depending on the frequency and application.

High Speed Access

Satellite technology is able to offer high speed Internet access to its subscribers at an incremental costs. With the ability to provide coverage to a large geographic area, many users can have shared access to this type of satellite content delivery service. Instead of paying for a dedicated service, as would be required with terrestrial service, users can pay a monthly subscription fee and enjoy the access speeds that would otherwise required a T3 (45 Mbps) or higher.

In addition, satellite technology's ability to surpass the 56 kbps terrestrial dial-up, makes it even more attractive for users to access the Internet. The return channel access speed is a function of economics can be as high as 256 kbps. With the introduction of caching technology, content can be pre-loaded at the end user's location and be served locally. Hence, reducing the amount of traffic necessary on the return link. Nevertheless, the need for higher speeds can easily be upgraded for satellite users since it merely involves some slight modification at the user's equipment and does not have to go through the pain staking process of replacing miles and miles of terrestrial lines.

"Internet in the Sky"

HNS' solution will involve the use of an IP based high-speed outbound carrier, capable of supporting up to 45 Mbps. This technology will allow delivery and distribution of Internet content to bypass the conventional terrestrial bottlenecks by beaming the information directly to the end user. In addition, this technology will allow the end users to receive IP multicast DVB based video at their desktop, large electronic package delivery, and software distribution.

HNS' solution will involve pushing content and intelligently caching it at the end user location. Furthermore, HNS is also actively working with Internet browser developers to come up with technologies to enhance Internet browsing capabilities over satellites.

Summary

HNS believes that with the proliferation of the Internet, streaming media will become increasingly popular. According to the *Content Delivery and Distribution 2000* report by Jupiter Communications, the revenue potential for streaming media is expected to hit US $2.5 billion by 2004. As the trend to deliver content closer to the end user continues, satellite's ability to provide economical and cost effective content delivery service will be in great demand. Our HNS satellite based content delivery and distribution system can carry any data using the IP protocol, especially data which is bandwidth intensive in the outbound direction, which is the characteristic of most Internet traffic. In addition, the broadcast nature of satellite transmission produces a highly cost-effective solution in reaching geographically dispersed sites. A dedicated high speed outbound broadcast, which enables IP multicast DVB based video to the desktop, large file delivery, and Intranet Web access coupled with its proprietary satellite friendly browser technology, the performance and bandwidth savings demonstrated is one step above the rest.

Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Wide-area Technologies and Services in the Trans-Pacific High Data Rate (HDR) Satellite Communications Experiments

Eddie Hsu, **Related authors**

Abstract

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INTRODUCTION

Government, academic, and industry teams in Canada, Japan and the United States have begun a series of Trans-Pacific experiments to develop and demonstrate the role of satellite communications in the Global Information Infrastructure (SC/GII). These experiments and demonstrations will help explore and develop satellite communications techniques, standards, and protocols in order to determine how best to incorporate satellite links with fiber optic cables to form high performance global telecommunications networks. The Trans-Pacific High Data Rate (HDR) Satellite Communications Experiments were initiated in 1996 as the result of a proposal by the Japan-U.S. Science, Technology and Space Applications Program (JUSTSAP), organized by the State of Hawaii. The Trans-Pacific High Data Rate (HDR) Satellite Communications Experiments included topics in high definition video transmission, collaborative remote astronomical observations, tele-medicine, tele-education, electronic commerce, and digital libraries [1-6].

The first experiment in the series to establish a dual-hop broadband satellite link for the transmission of digital high definition video (HDV) over an asynchronous transfer mode (ATM) network was the Trans-Pacific High Definition Video Experiment [1-3]. It demonstrated that modern broadband satellites can deliver data rate and quality comparable to terrestrial fiber optic networks, and realized the digital studio/theatre anywhere concept. Digital HD cinematography could be conducted from virtually any location in the world, and the results of post-production could be viewed on remote monitors and projection systems almost instantly. The successful post-production activity performed between Tokyo and Los Angeles predicated on the seamless interoperation of all the equipment between the two sites.

This was followed by Internet Protocol (IP) based experiments and demonstrations [4-6] in tele-medicine and distance-education using a combination of terrestrial fiber optic networks and two high data rate geostationary satellites for a total signal path exceeding 100,000 miles across Canada, Japan, and the United States. The use of IP based technology - with the notion of IP-over-everything and everything-over-IP -- facilitated the participation of students and even general users in the exciting international activities of using satellite communications in the global information infrastructure. It would also help examine issues in constructing a next generation global/solar-system-wide internetwork involving broadband satellites, and would provide an opportunity in applying cutting edge research results from reliable multicast and distributed systems communities. Moreover, the activities help study and develop new technologies and service models, and can span to include activities in global-scale virtual presence, solar system internetwork, disasters mitigation, and other high data rate, distributed applications.

The Visible Human tele-medicine and Remote Astronomy distance education demonstrations and their use of distributed systems technologies afford an opportunity for people around the world to work together as a virtual team under one roof, using resources thousands of miles away as if they were next to each other. The visible human activity demonstrated global-scale interactive biomedical image segmentation, labeling, classification, and indexing using large images; the remote astronomy activity demonstrated collaborative observation and distance education at multiple locations around the globe.

SYSTEMS IN GLOBAL-SCALE DISTRIBUTION

As people, organizations, and resources become more distributed and mobile in nature, a global information infrastructure involving broadband satellites facilitates the bridging of distant geographical areas, and makes resources available to anyone, anywhere, at anytime. In such an environment, the ability to transmit large amounts of data in a timely manner, effectively share resources such as computing clusters, and process information in a distributed manner - on a global and perhaps interplanetary scale - becomes more important, and the distinction between communication networks and distributed systems becomes less clear. The increasing distribution of users and systems brings with it issues of scale, heterogeneity, robustness, and interoperability [7-9]:

- Scale: Evolving systems are serving increasing number of users: from one to several users per server of recent past to easily hundreds and thousands of users today. A system must use its resources effectively and efficiently, and should possess favorable scaling properties.

- Heterogeneity: Various types of systems are expected to work together. The equipment in a large system would represent a spectrum of differences in terms of speed, capacity, functionality, etc. The range may include institutional-level equipment close to high bandwidth communications backbones to end-users-level equipment in homes or on the road. A desirable system should accommodate different components simultaneously and deal effectively with such variations.

- Robustness: An ideal solution for a large-scale system could be one that can configure itself autonomously. It would permits a system to adapt to changing conditions with minimal operator intervention. For instance, link outages and network partitioning in a large-scale system should not be seen as an exception but a norm. A robust system, therefore, needs to deal with such challenges in a graceful way without adversely affecting a large number of users.

- Interoperability: Distribution, scale, and heterogeneity mean increased system dynamics. A robust interoperable solution should permit different systems to operate together efficiently. The involvement of new systems, such as broadband satellites and wireless mobile networks, tasks traditional protocol mechanisms and brings out new performance and interoperability issues not previously relevant.

The Trans-Pacific experiments and demonstrations help examine communications issues in these context through implementing a series of activities including the high definition video experiment, the visible human digital library/distributed processing demonstration, and the remote astronomy distance learning/collaborative discussion application. The high definition video experiment demonstrated the transmission of high volume, timing-critical digital video streams between Los Angeles and Tokyo, and showed the feasibility of real-time, remote cinematography post-production at locations not served by terrestrial high speed networks or where such an infrastructure is not feasible. The Visible Human tele-medicine and Remote Astronomy distance education demonstrations and their use of distributed systems technologies provided an example of how students and perhaps the general public around the world could work as a virtual team under one roof, process information cooperatively in a distributed manner, share resources and collaborate with each other as if they were next to each other.

These activities would help study and develop new technologies and service models in a global information infrastructure, and can span to include activities in global-scale virtual presence, solar system internetwork, disasters mitigation, and other high data rate, distributed applications.

PHASES ONE AND TWO OF THE TRANS-PACIFIC EXPERIMENTS AND DEMONSTRATIONS

Phase 1: High Definition Video Experiment

In the Phase 1 high definition video experiment, source material was transmitted and composited in real-time between Los Angeles and Tokyo, demonstrating that satellites can deliver digital image traffic at data rates up to Asynchronous Transfer Mode (ATM) OC-3 rate (155 Mbps) and with quality comparable to that of fiber optic cables. Also, it showed the effectiveness of modern broadband satellites in the global information infrastructure, linking locations where terrestrial fiber optic infrastructure is not available or not feasible. The experiment involved the use of two broadband satellites and three terrestrial fiber optic networks, including one in the State of Hawaii.

In the traditional way of film-making, performing blue/green-screen cinematography with photographic materials often takes many iterations and weeks between the director and the film laboratory to produce images matching the director's vision. The digital virtual studio concept demonstrated by the experiment would allow the post-production processing to be done in real-time and from virtually any location on the global. The results may also be viewed at remote locations using portable HDV monitors. This made possible the instant review of compositing results by the director, and allowed immediate changes by the remote cinematography team to meet the director's liking. The real-time post-production activities therefore significantly cut down on the amount of time needed for the compositing process, as well as shorten the length of time a cinematography team and props needed to be deployed at a remote location.

The HDV streams were transmitted over ATM connections using MPEG-2 compression. The output data rates of the experimental HDV codec used could be selected from 22.5 Mbps, 60 Mbps, and 120 Mbps. The 22.5 Mbps mode was used in the experiment. The experimental device had a small buffer, and therefore required strict timing synchronization to prevent overrun/underrun situations. An off-sync condition resulting from cell-loss affected the video in the way of frozen images (freeze-frame). There were no large, scrambled blocks or distorted audio as reported in other implementations [10, 11]. In this way the codec robustly handled the cell-loss condition. The codec was interfaced to the Trans-Pacific network using ATM AAL-5 through a Cell Layer Assembly and Disassembly (CLAD) device. The MPEG-2 codec transformed the video stream into ATM cells for AAL-5. Typically, AAL-1 would be used to compensate delay variation for constant-bit-rate (CBR) applications, since AAL-5 was not meant to have such function. The experiment demonstrated that the Trans-Pacific satellite/terrestrial hybrid network provided a high quality link, which did not require AAL-1 function to be used.

The highly successful experiment resulted in the initiation of several new satellite systems and techniques for post-production processing and distribution of digital cinematography products. Coupled with advanced network technology, such as reliable multicast, efficient virtual studio and digital theatre concepts would become possible anywhere, at anytime.

Phase 2: Visible Human And Remote Astronomy Demonstrations

The Phase 2 demonstrations in Year 2000 included Visible Human and Remote Astronomy. The tele-medicine, or Visible Human demonstration, used the network to conduct remote, collaborative medical processes between the National Library of Medicine (NLM) of the United States National Institute of Health (NIH) in Bethesda, Maryland, and the Sapporo Medical University (SMU) in Sapporo, Japan. The Remote Astronomy demonstration afforded students hands-on ability to control a remote telescope located at the Mt. Wilson Observatory, California, simultaneously from their classrooms in Japan and across the United States. The demonstrations involved two broadband satellites and terrestrial fiber optic networks in Canada, Japan, and the United States.

Visible Human

The Visible Human tele-medicine demonstration showed a distributed application model enabling interactive biomedical image segmentation, labeling, classification, and indexing to take place over large images on a global scale. It involved a digital image library of volumetric data representing a complete, normal adult male and female cadaver (The Visible Human Project) currently residing at the NLM in Maryland. The thinly sliced images in the datasets are of cryosections derived from computerized tomography and magnetic resonance. Due to the size and international importance of the dataset, multilingual labeling of the dataset was proposed. The model facilitated multi-lingual access to the datasets through interactive whiteboard medical-image-based consultation, with multi-lingual assistance for collaborative work between medical researchers in different countries. Available global-scale high speed access to an anatomical segmented human anatomy atlas would be a vital resource for biomedical researchers worldwide.

The demonstration involved software tools to show sections of a human body, and enabled a researcher to make an interactive segmentation in order to recognize each anatomical object. Also, it calculated and filled areas in the segment and rendered them in a distributed manner. This would be followed by the attachment of anatomical terms to the objects working with the NLM's Unified Medical Language System and creating a multilingual object database. Visible human data would then be transferred to and from the researcher world-wide over a high performance network. Processing of large datasets would be expedited and simplified with available computational resources at various locations. Transmission Control Protocol (TCP) gateways for communication over satellites were also installed on both sides of the Pacific to enhance transmission performance over the satellite links.

Remote Astronomy

The Remote Astronomy tele-education demonstration created a wide-area environment for distance learning and collaborative discussions/observations using IP based teleconference (H.323 and multicast) and AFS distributed file system technologies. The remote astronomy system helped bring a remotely controlled telescope and charge-coupled device camera in a real-time, hands-on, interactive environment to students and even the general public around the world.

The demonstration consisted of global-scale joint observations, distributed image access, and instruction sessions by an astronomer in Pasadena to students located in Japan and the United States. Instructors from Soka High School and astronomers from the California Institute of Technology, Mt. Wilson Institute, and the University of Maryland also participated. Observation sessions would start at 9 p.m. on the United States West coast with other participants in the United States and Japan logging into the videoconference server and the Mt. Wilson telescope server at the beginning of the session. Students in Japan would be participating in the afternoons in Tokyo. The astronomer in Pasadena would then lead lectures and observations with themes such as the structures of galaxies, lives of stars, and where are all the stars. Students and other participants in the US and Japan were asked to control the telescope in turn, and the images acquired by the controlling site were distributed via AFS distributed file system to all other participants. Images from the Hubble Space Telescope archive images were also used to compare and contrast with those taken with the Mt. Wilson telescope. All participants were able to observe each other's activities as if all were sitting in one room. It would be possible for one site to be responsible for taking pictures, while others carrying out image processing on the pictures taken, with results for all participants to see.

For the Phase 2 IP-based demonstrations, the large bandwidth delay product of the satellite links on TCP were mitigated by the use of special performance-enhancing gateways. The use of distributed storage systems and local processing would help enhance communication performance in increasing the amount of useful data returned. For applications that are not accelerated by the gateways, such as distributed file systems, they would experience lower throughput over satellite links if the parameters were not suitably tuned to reflect the broadband links. Many of these performance issues in distributed systems were similar to the well publicized TCP-over-satellite issues on window sizes, timer settings, loss recovery mechanisms, and acknowledgement schemes.

It is therefore important to consider at onset the characteristics of emerging high speed, long distance networks on protocol mechanisms and their designs in all types of communications and distributed systems. Perhaps an evolution path should be defined early on to facilitate the future integration of such networks.

TOWARDS A HIGH PERFORMANCE GLOBAL INFORMATION INFRASTRUCTURE

The capabilities afforded by an emerging information infrastructure of the global scale emphasize the distributed nature of today's information systems. People, resources, and organizations are becoming more distributed. Powerful communications networks serve to connect people at distant places, permit sharing of resources such as computers, storage, and observatories. The reach of today's users is farther than ever before. An ever-blurring boundary between network and distributed systems in a wide area information infrastructure would have desirable properties in providing transparent access to users anywhere and facilitate people over wide geographical areas to work together as if under one roof.

High definition systems provide the necessary video quality to enhance the virtual presence experience. Such systems, generating large volume of time-critical data, require strict synchronization between all equipment in the network. Cutting edge compression techniques, coupled with layered encoding, would permit equipment of differing capabilities to communicate with each other. For instance, users on a high bandwidth backbone would receive high quality video, while those on a lower bandwidth edge networks would receive the same video but with lesser quality [12-13].

Multicast is well suited for applications that are distributed in nature. Examples of such applications include tele-education, video-conferencing, digital libraries, wide-area data distributions, etc. The use of multicast technology would be important to mitigate the ever-increasing demand for bandwidth, such as those seen in the Trans-Pacific series of experiments thus far. The issues such as local error recovery, reliability mechanism, receiver heterogeneity, and scalability in a global scale infrastructure involving the characteristics of broadband satellites ¾ as well as the need to carry time critical traffic to users that are becoming ever more mobile ¾ offer rich areas for additional research.

One of the challenges in the current Internet infrastructure is the amount of quality of service (QoS) that a network can provide on the global scale. While it is possible to obtain a high level of QoS over dedicated IP configurations and over a small subset of the network, the effort in implementing the same level of QoS in the global Internet as required by applications such as the high definition video experiment would be significant. The rate at which emerging research results could be deployed on a global scale would most likely depend upon suitable business cases, and would undoubted be expedited if research and other large organizations could start making use of them in their daily operations.

Future experiments using multicast, mobility, and differentiated services for IPv6 over dense-mode wavelength division multiplexing will be candidates for study. The activities could include applications in the area of global-scale virtual presence, solar system internetwork, disasters mitigation, and other high data rate, distributed applications.

CONCLUSION

In 1993, a proposal at the Japan-U.S. Science, Technology, and Space Applications Program (JUSTSAP) workshop, organized by the State of Hawaii, lead to a subsequent series of satellite communications experiments and demonstrations, under the title of Trans-Pacific High Data Rate Satellite Communications Experiments. These experiments and demonstrations, initiated in 1996, were designed to help explore and develop satellite transmission techniques, standards, and protocols in order to determine how best to incorporate satellite links with fiber optic cables to form high performance global telecommunications networks.

As people, organizations, and resources become more distributed and mobile in nature, a global information infrastructure involving broadband satellites serves to bridge wide geographical distances and make information and equipment resources available to anyone, anywhere, at anytime. In such an environment, the ability to effectively share resources and capabilities in a distributed manner ¾ on a global or even an interplanetary scale ¾ becomes important, and the distinction between communications networks and distributed systems becomes less clear.

This paper describes the technologies and services used in the experiments and demonstrations using the trans-Pacific high data rate satellite communications infrastructure, and how the environment tasked protocol adaptability, scalability, efficiency, interoperability, and robustness. In subsequent work, the use of IPv6 differentiated services, [reliable] multicast, high-definition multi-party conferencing and data sharing, and increasing types of distributed application services over a combination of broadband satellite links and terrestrial dense-mode wavelength division multiplexing connections will be examined.

PARTICIPANTS

The Canadian participants included AT&T Canada, BCnet, CANARIE, Communications Research Centre (CRC), and Teleglobe Inc.; the Japanese participants included Communications Research Laboratory (CRL), Institute of Space and Astronautical Science, Japan Ministry of Posts and Telecommunications (MPT), JSAT Corporation, Inter-Ministry Research Information Network (IMNet), Japan Gigabit Network, Kokusai Denshin Denwa Company, Limited (KDD), Mitsubishi Electric Corporation, Nippon Telegraph and Telephone Corporation (NTT), NTT Communications, Sapporo Medical University, Soka High School, and Sony Corporation; the U.S. participants Apple Federal Systems, ATDNet, AverStar Inc., California Institute of Technology, Comsat, Crossroads High School, George Washington University, GTE Hawaiian Tel, Lockheed Martin, Mentat Inc., Mt. Wilson Institute, NASA Glenn Research Center, NASA Goddard Space Flight Center, NASA Headquarters, NASA Integrated Services Network, NASA Jet Propulsion Laboratory, NASA Research and Education Network, National Library of Medicine/National Institute of Health, Newbridge Networks Inc., Pacific Bell/CalREN, Pacific Space Center, Sony Pictures High Definition Center, Science, Technology and

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[i] The Japan-U.S. Science, Technology, and Space Applications Program (JUSTSAP) is a cooperative program officially sponsored by the State of Hawaii, with academia, industry, and government participation.

Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Satellite Internet: Technical Advancement and business scope

Shuichi Yoshino and Yoshitsugu Yasui

Abstract

http://www.ntt.com

Introduction

Fast popularization and technical development of cellular phone and Internet change the shape of telecommunication. The contents handled in Internet become more complex and larger than ever. The cellular phone is advanced to be a personal data assistant (PDA). Moreover, not only conventional data transfer i.e., http or ftp, but real time stream transmission in Internet becomes more frequent. The transmission performance such as throughput and instantaneous response will be crucial even though high speed network will be available. Although optical fibers are deployed at major links, it is required to evaluate the end to end performance including customer devices and their access links.

Therefore, efficient transmission techniques to maximize network resources are required. For this purpose, queuing, caching, load balancing and multicasting techniques are developed aiming to control traffic and alleviate congestion.

On the other hand, direct broadcast satellite (DBS) market expands very rapidly due to its ubiquitous and broadband transmission capability. Also, satellite is focused as an Internet application because of its instantaneous network deployment, broadcast ability and broad bandwidth to the customer.

Satellite can become an efficient instrumentation at conjunction with Internet and DBS framework.

In this paper, the developed multicast satellite Internet system is described, which can maximize the advantage of satellite system. The technical features and actual commercial application of the system is explained.

Satellite Internet System

The Internet traffic is generally much asymmetrical between content provider and receiver. In this sense, satellite link is much suitable for this traffic because contents provider can provide expensive satellite up-link instead of the customer. Also, since some popular contents are requested by a number of customers, broadcasting ability of satellite is much effective. The typical comparison about customer numbers and total system link cost is shown in Fig.1. Theoretically, in case that has enough number of sharing customers in system, satellite can reduce the cost per customer by multicasting capability.

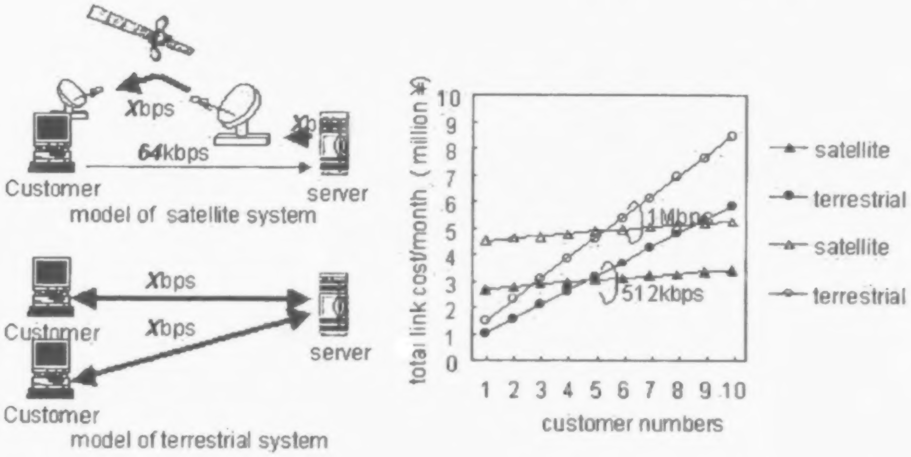

Fig.1 The comparison about customer numbers and total link cost of system

These are frequently mentioned explanations when advertising the benefit of satellite application to Internet. However, these

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stories undermine the following questions.

(1) How is the benefit of asymmetry of the Internet traffic applied to satellite link?

(2) How efficiently can multicast cut the cost of link?

The asymmetry of Internet traffic itself does not produce sufficient benefit for satellite link utilization comparing with usual terrestrial link. Even though customer does not pay for expensive uplink, the downlink cost is still high in current satellite system. Also, multicast itself cannot satisfy customer expectation, because Internet is originally designed for request oriented usage and the contents handled in Internet tend to be much personalized.

To strive for these issues, an autonomous request management and traffic controlling system was developed and examined.

Basic design

The basic design of satellite Internet is using small terminal at customer, which uses a terrestrial connection or a narrow band satellite up-link. The system configuration is presented in Fig.2.

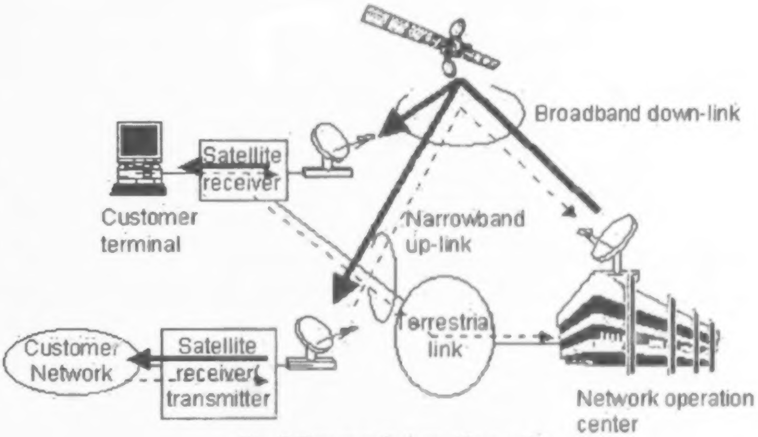

Fig.2 The system configuration

The network operation center (NOC) controls the contents delivery, contents storage, and time scheduling and bandwidth allocation. If using satellite link as a simple bent pipe of Internet access, user can access Internet contents site trough the satellite as the same manner as terrestrial ones. In this usage, the difference between satellite and terrestrial system is only that it uses airwave instead of the wires of copper cable or optical fiber. The satellite link is established by the modulator with DVB-ATM/IP transformer. At the receive side i.e., customer side, the IP packet is reassemble and forward to the external LAN port or the application layer on PC. In the asymmetric configuration, the standard satellite Internet link can provide up to several hundreds kbps speed even without any protocol translation spoofing technique to accelerate TCP.

Since the DBS platform provides about total 30Mbps bandwidth per a transponder, in this sense only some hundreds of customers can fully utilize the satellite link simultaneously. Even though statistic multiplex effect is considered, the satellite down link seems to be still expensive because these limited customers have to share the total satellite link cost. The comparison about customer numbers, link cost and maximum throughput is illustrated in Fig.3.

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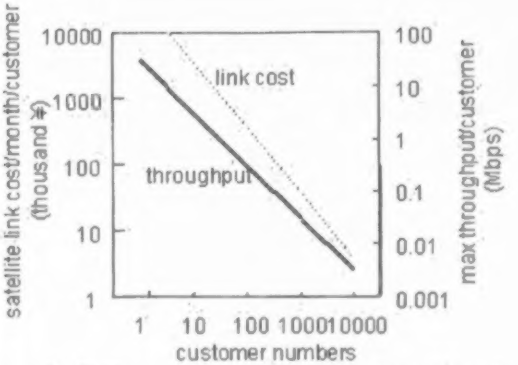

Fig.3 The comparison about customer numbers, link cost and maximum throughput

As shown in this figure, the straightforward approach cannot compete with terrestrial service. The direct satellite Internet access to the customer seems to be confined as complementary for rural area or isolated place without terrestrial alternatives. If satellite service intends to compete with terrestrial ones, in terms of available bandwidth, it does not make sense to expect arbitrary statistic condensation effects in finite bandwidth. It may yield to sacrifice customer throughput. Therefore, positive and rigorous controlled condensation of the traffic is desired to make cost effective bandwidth utilization.

Autonomous Scheduling Transmission

To realize positive control of the traffic, the management system is introduced to control entire bandwidth, time schedule and contents. This is implemented at the operation center working with the information from all of the participating receiving terminals. It is also required to enhance the total bandwidth utilization efficiency by giving higher priority to the multicast data traffic than the unicast data. Because the bandwidth should be shared with as many customers as possible, the unicast from individuals should be penalized. Also, in general, since multicast data is formed of UDP, it is vulnerable against the traffic congestion. The protection of multicast data is required. The developed system is designed based on a "push" data transmission scheme that has a center to customer autonomous data delivery capability. Hence, the system can control and condense the entire traffic actively at NOC. The contents are temporarily stored at the data server in NOC and delivered according to the schedule by multicast manner. The contents are in the two kinds of categories. One is streaming data such as live video or time critical data. The other is none real time data such as file transfer. The scheduler of the system autonomously controls the delivery timing based on this classification to intend to fill the satellite link efficiently. The configuration of this system is shown in fig.4.

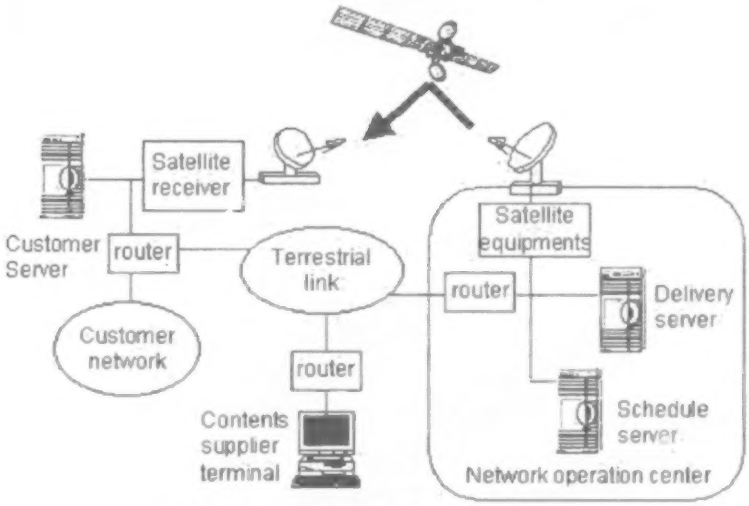

Fig.4 The configuration of this system

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Two types of servers are working at NOC. The schedule server is to register contents from contents providers and to establish an optimal schedule management. The delivery server is to transmit actual contents in the waiting queue to the satellite. The contents provider registers the contents with the classifications and requests the delivery time and quality, which is interactive operation with the schedule server. In accordance with the information from the contents provider and the current status of the scheduler, the schedule server finds an optimal time slot and responds to the contents provider. Once the schedule is registered, if required, the schedule information is advertised to the customers. The delivery server transmits contents to the satellite link triggered by the schedule server in the reserved bandwidth and priority. A bandwidth allocation example by this system is presented in fig.5. This system can deliver "push" contents to the customers by comprehensive-control manner.

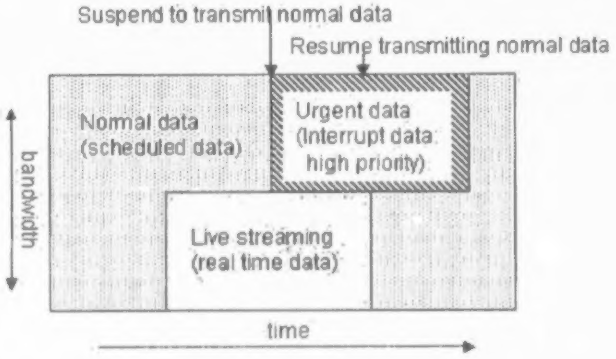

Fig.5 The link utilization image allocated by this system

This system may extend to use as an Internet information delivery platform for the general Internet service providers, which have much desires to delivery company advertisements and keep its popularity.

Quality control with ATM

If the system is served as an contents delivery platform for the contents providers, quality control will be a crucial matter, that is totally different from usual Internet access from the arbitrary customers. The purpose is to deliver their responsible contents to the customers, not to promote individual Internet access. The contents should be delivered certainly to the customers.

In the proposed system, standard UDP protocol is utilized to handle streaming data working with the extended networks including Internet. Therefore, the quality control at the protocol layer level cannot be expected. The positive quality control with transmission layer is required. Since the satellite link utilized here is unidirectional pre-bandwidth allocation link, the bandwidth can be controlled by the operator at the NOC. The bandwidth allocation will be performed considering traffic condition and data priorities at the NOC. Because the delivery server can control the transmit speed for each multicast packet, the occupied bandwidth can be constrained strictly within the specified amount based on the schedule information. In addition to that, to control the quality of the entire satellite link, the proposed system employs the IP over ATM scheme as data transfer, loading every IP packets into satellite transmission frame by pre assigned strict manner. Therefore, the quality control of the total satellite link can be implemented on ATM layer. The advantage of implementing QOS by ATM is that commercial proven ATM products are available. Also, the system becomes adaptable to the ATM network. The protocol stack of the system is shown in fig.6. The accurate quality control can be realized even for handling a number of contents including streaming, which have a various speed and priority, by this architecture using schedule server and ATM.

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IP (controlled by the delivery server)
ATM (controlled by the ATM product)
MPEG Transport Stream (controlled by the satellite equipments)
Satellite link

Fig.6 The protocol stack

In addition to that, it should be ensured to make reliable contents receiving function in case of data delivery even through a rough air condition via satellite. The proposed system implements retransmission function requested by the receiving terminals using terrestrial return link. The system utilizes RMTP protocol to ensure a reliable multicast data transmission. For streaming contents, generally retransmission is not available. The continuity of the data stream and instantaneous operation is more important. The retransmission function is optional according to their demands.

User Interface

Two kinds of user interfaces are provided. The configuration of the user interfaces is illustrated in fig.7. One application is that the individual customer receives contents directly. In this case, the customers will have a capability to receive every content via satellite likewise broadcast satellite TV programs. However, under the present situation, the storage capabilities and capacities of each Internet customer are different and limited in general. Also, individual customers will not conduct data management of their PCs including data selection and store for 30 Mbps data shower from satellite by themselves. Therefore, the system provides the delivery schedule table of contents to the customer in advance of the delivery and implement data selection at the receiving terminals according to the customer requests. The customers will receive and store only pre-registered contents. Moreover, the system operator can collect the access log of the all customers, that is important for contents provider to manage their business.

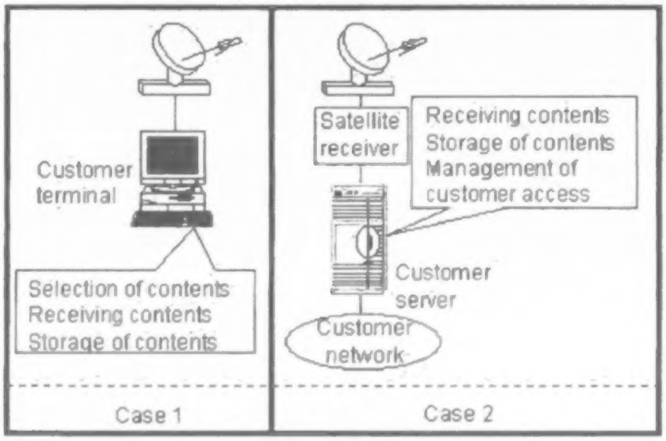

Fig.7 The configuration of the user interface

The other approach is to delivery data to the servers in local network such as the cash server of ISP or the gateway server of company network. In this case, generally enough storage capacity can be prepared for the servers, so that it is not necessary for the customers to select contents at receiving terminals. The selections will be done in their own networks outside of the satellite network. A number of distributed local servers connecting to the satellite network can be controlled from the satellite data delivery system that performs server storage, data deletion, maintenance, conditional access and etc. The access log of each server is also reported to the delivery system at NOC.

System Performance

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The proposed system has a capability to handle the bandwidth up to 30Mbps provided by DBS platform. The speed of each contents transmission can be selected from 64kbps to 6Mbps. The single channel throughput of the retransmission reliable delivery of the current system is 2.5 Mbps. This may be improved with high-speed data processing at the receiving side.

The prototype of the system has been developed for both the customer direct receiving system and server management system. Further efforts are to investigate actual capacity needed for the customer in real environment with/without retransmission requirement, and to find the parameters for the operation in actual usage, i.e., update period, load balance and backup scheme etc. The schematic image of the preliminary test is presented in Fig.8.

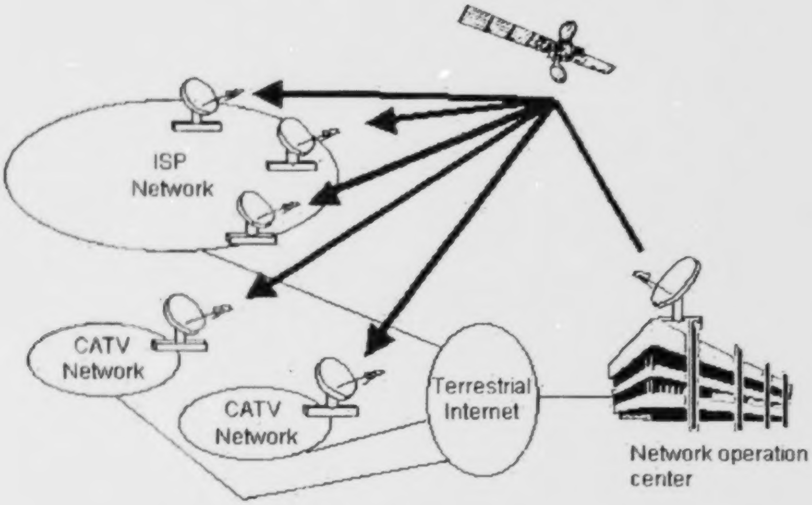

Fig.8 The schematic image of the preliminary test

Future Broadband Satellite Service

The desires to access contents unlimitedly and quickly will solicit the need for broadband services. In Japan, associated with BS digital broadcasting service, data-broadcasting service is launched in December 2000. This may give us an insight of new business models. It will imply what data are expected to broadcast. Also, associated with streaming data, Internet changes its usage much like broadcasting.

On the other hand, caching servers and mirroring servers will be installed more in network than ever in business usage to secure the quality of the network. Therefore, it will be required to delivery a number of heavy contents to multiple servers promptly. Moreover, the storage capacity of the customer device is increasing very rapidly with technology advancement. The function of caching servers and mirroring servers in local network may be move into the end customer device in near future. To handle a tremendous number of the servers in the network, multicast satellite Internet system is the most effective approach in comparison with the terrestrial counter parts. It should be noted that the positive data delivery control introduced here would be a prime concern when applying satellite system to the future broadband network working with Internet.

Conclusion

The latest achievements of satellite Internet development and future forecast of broadband systems are addressed. The satellite system is still expensive comparing with terrestrial alternatives even taking into account its advantages, such as ubiquity, instantaneous deployment and bandwidth for the end customers. In terms of business development, there will be two courses. One is that satellite will be limited to the application to rural or remote area, which has difficulties to have terrestrial alternatives. The other is that positive controlled data delivery satellite system is developed to maximize multicast and center to end capability to compete with terrestrial systems. In the broadband era, the independently extended and passively controlled Internet system needs to make comprehensive examinations to handle heavy data in entire network connected with a number of providers and customers. The developed satellite system herein is a positive controlled multicast satellite system, which will provide one of the directions for future advancement of broadband Internet.

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Back to top of page **Back to the sessions page**

Abstract

The rapid technical development and popularity of cellular telephones and the Internet are changing the shape of telecommunications. Internet content is becoming larger and more complex, especially because of demand for real-time streaming audio and video. The cellular telephone is turning into a personal data assistant (PDA).

Transmission performance parameters such as throughput and instantaneous response will be crucial even though a high-speed network will be available. Although optical fibers are deployed for major links, the end-to-end performance evaluation has to include customer devices and their access links. Therefore, efficient transmission techniques to maximize network resources are required. For this purpose, queuing, caching, load balancing and multicasting techniques are being developed to control traffic and alleviate congestion.

On the other hand, the direct broadcast satellite (DBS) market is expanding very rapidly thanks to its ubiquitous and broadband transmission capabilities. Also, satellites are favored for certain Internet applications because of instantaneous network deployment capability, broadcast ability and broad bandwidth to the customer. Satellites can become an efficient delivery medium within the framework of the convergence of the Internet and DBS. In this paper, a multicast satellite Internet system is described that can maximize the advantages of a satellite delivery system. The technical features and actual commercial application of the system are explained.

Go to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Waveform Advances for Satellite Data Communications

John Puetz and **Mark Dankberg**

Abstract

www.masterworkscomm.com (MasterWorks Communications)
www.viasat.com (ViaSat, Inc.)

1. Introduction

Satellite links have been used for many years for point-to-point, broadcast, and networked digital data transmission. Recent advances in satellite modem, coding, and digital signal processing technology offer the prospects of significantly increasing the capacity of satellite circuits. In the past few years the worldwide volume of digital data traffic has been soaring - driven by the Internet. Data traffic is growing much, much faster than voice traffic. In fact, observers note that data traffic accounts for virtually all of the growth in commercial communications satellite traffic over the last several years. Because of this growth there is great interest and motivation to apply the most modern technologies to increase the data handling capacity of existing and planned satellite transponders.

While well understood, satellite link maximization involves balancing and trading-off many different characteristics, including:

- Antenna dish sizes
- Power amplifiers outputs
- Interference to and from adjacent satellites
- Interference to and from adjacent channels on the same satellite
- Linear vs. non-linear operation of transponders and ground stations

Three new modem and coding technologies have emerged that can improve the data rates that can be achieved over satellite links and that may change the way that systems are optimized. Broadly speaking the technologies are:

- Turbo codes. A class of iterative codes that allow modems to work at significantly lower signal to noise ratios than convolutional/Viterbi codes or concatenated Viterbi - Reed Solomon codes. These codes are especially useful for links that are limited by available power (signal to noise ratio in dB).
- 8-PSK. Or similar "Trellis Coded" modulation (TCM) waveforms get more bits per second per Hz of bandwidth than other high rate coding options (such as QPSK with R=3/4 or R=7/8 coding). 8-PSK can be combined with concatenated or Turbo Codes. These codes are especially useful for links that are limited by available bandwidth (MHz).
- Paired Carrier Multiple Access (PCMA) is a frequency re-use signal cancellation technique that allows both directions of a circuit to re-use the exact same bandwidth. PCMA can be very effectively applied to circuits that are either power or bandwidth limited.

Although all of these techniques are applicable to networked systems, for purposes of this paper we will focus on continuous, steady state 2-way symmetric data circuits.

2. Link analysis

The satellite data capacity of a circuit is determined by the modem modulation and coding techniques. The key characteristics are:

- Modem Bit Error Rate (BER) vs. Eb/No (energy per bit to noise power spectral density ratio measured in dB).

- Bandwidth efficiency, measured as Bits / sec / Hz (or bps/Hz). This is determined by the underlying signaling rate and the pulse shaping applied to each channel symbol.

The data rate that can be supported through a given link is directly related to the Eb/No of the modulation and coding waveform and the end-to-end C/No (Carrier power to noise power spectral density, measured in dB). The C/No is determined by the ground station parameters (dish size, power amplifier size, noise temperature) and satellite parameters (EIRP, G/T, saturation flux density settings, etc). C/No, Eb/No and useful data rate (information rate) are related as follows:

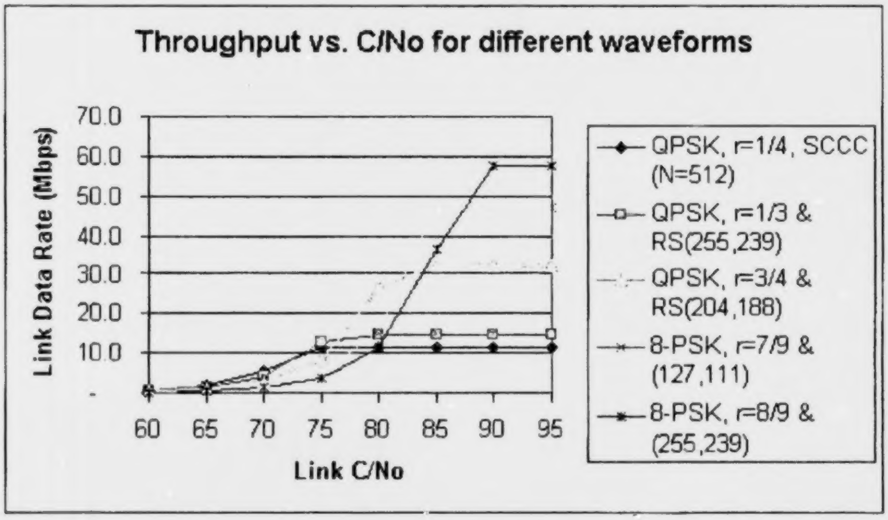
$$10 \times \log_{10}(\text{Information Rate}) = C/No - Eb/No$$

So, for a given link C/No, the information rate is maximized by using the waveform that has the best (lowest) Eb/No. However, the maximum data rate that each waveform can support is limited by its maximum bps/Hz and the available bandwidth.

For each candidate waveform we can tabulate the key parameters of Eb/No and effective bits/sec/Hz. The Eb/No allows for a practical modem implementation loss.

Modulation	Convolutional Rate	Reed Solomon Rate	bps/Hz	Modem Eb/No
QPSK, r=1/4, SCCC (N=512)	0.2500	1	0.4274	2.50 dB
QPSK, r=1/3 & RS(255,239)	0.3333	0.937254902	0.5340	3.88 dB
QPSK, r=1/2 & RS(204,188)	0.5000	0.921568627	0.7877	4.55 dB
QPSK, r=3/4 & RS(204,188)	0.7500	0.921568627	1.1815	5.75 dB
8-PSK, r=2/3 & (255,239)	0.6667	0.937254902	1.6021	6.38 dB
QPSK, r=7/8 & RS(204,188)	0.8750	0.921568627	1.3784	6.65 dB
8-PSK, r=7/9 & (127,111)	0.7778	0.874015748	1.7431	8.08 dB
8-PSK, r=5/6 & (255,239)	0.8333	0.937254902	2.0027	8.28 dB
8-PSK, r=8/9 & (255,239)	0.8889	0.937254902	2.1362	9.38 dB

The table above shows Eb/No and bps/Hz associated with a number of different coding schemes. The chart below shows the results of applying these candidate waveforms to satellite links over a typical 27 MHz transponder.



The chart shows that the waveforms that perform the best at a low signal to noise ratio become bandwidth limited as the link signal to noise ratio increases. Conversely, the waveforms with the highest throughput at high C/No perform worse at low signal to noise ratios.

When C/No is low it's apparent that the best waveform choice is the one with the lowest effective code rate (having the greatest coding gain). If the C/No increases to the point where that waveform becomes bandwidth limited (i.e. the data rate reaches a plateau), then the best strategy is to "jump" to the next higher code rate - allowing the excess power to be converted into more bps/Hz, at the expense of a higher Eb/No.

Satellite systems engineers can optimize efficiency by asking the following questions:

1) Given a specific link C/No and Eb/No; what's the best bps/Hz I can get?

2) Given a specific bps/Hz target; what waveform reaches that efficiency at the lowest Eb/No?

3. New technologies

The new technologies are essentially characterized by the way they improve either power performance (Eb/No) or bandwidth efficiency (bps/Hz) or both.

3.1. Turbo coding

The main advantage of turbo coding is that it reduces the Eb/No needed to close a link at a given code rate. Known turbo codes at reasonable block size and complexity can come quite close to the Shannon channel capacity limit (within about 1 to 2 dB). For instance, a R=1/3 turbo code can achieve a BER of about 10-7 at an Eb/No = 1 dB with a block size of less than 2000 bits. Reducing the code rate to R=1/4 would reduce the Eb/No required to about 0.7 dB.

Turbo codes can also be applied effectively to higher rate codes. The table below shows some example code rates with associated Eb/No and approximates bps/Hz performance.

Waveform	Code Rate	Eb/No	bps/Hz	Block Size
QPSK	1/4	0.7	0.43	< 2,000
QPSK	1/3	1	0.57	< 2,000
QPSK	2/3	1.8	1.14	10,000
QPSK	3/4	2.3	1.28	10,000
QPSK	5/6	3.1	1.42	10,000
QPSK	7/8	3.5	1.50	10,000
QPSK	15/16	4.5	1.60	10,000

3.2. High-Order Modulation

The main advantage of higher order modulation is that it increases the achievable bps/Hz compared to the more common QPSK. The two most common higher-order waveforms available in off the shelf products are 8-PSK and 16-QAM. Depending on the implementation, 8-PSK may be operated with a non-linear (saturated) power amplifier at the earth station and/or satellite transponder. However, the 16-QAM signal must be used with linear channels - which can significantly reduce the link C/No compared to a saturated transponder.

Some representative data for 8-PSK and QAM waveforms with convolutional and/or concatenated coding are illustrated below.

Waveform	Code Rate	Eb/No	bps/Hz
8-PSK	2/3	6.9	1.5
8-PSK	5/6	8.8	1.9
8-PSK	8/9	9.5	2.0
16-QAM	3/4	8.9	1.6
16-QAM	7/8	10.6	1.9

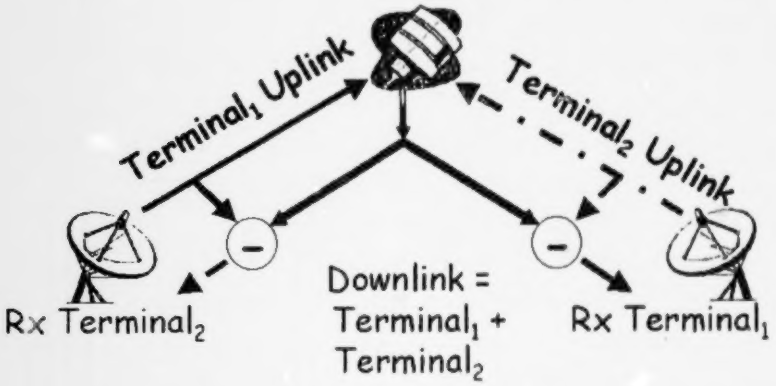
Higher order modulations could also be combined with Turbo coding. These would yield the additional coding gains from the iterative codes, while still retaining increases in bps/Hz. Some based on theoretical performance are given below:

Waveform	Code Rate	Eb/No	bps/Hz	Block Size
8-PSK	2/3	4.8	1.71	4,096
8-PSK	3/4	5.7	1.92	4,096
8-PSK	7/8	8	2.24	4,096

3.3. PCMA

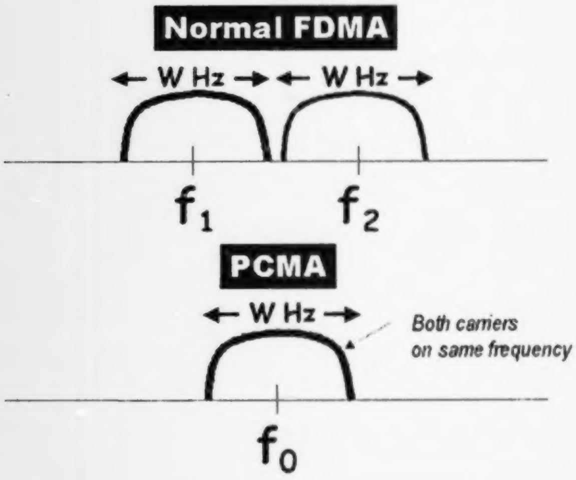
The main advantage of PCMA is that it can effectively double the available bandwidth for links that are either power limited or band-limited. This is an unique advantage.

Paired Carrier Multiple Access (PCMA) is a signal cancellation technique that allows both directions of a data link to re-use the exact same frequencies. The basic concept is shown in the figure below.

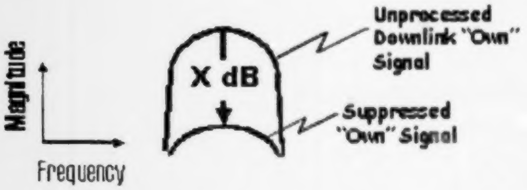

Terminal$_1$ Uplink
Terminal$_2$ Uplink
Rx Terminal$_2$
Downlink =
Terminal$_1$ +
Terminal$_2$
Rx Terminal$_1$

Each terminal receives both its own signal and the desired signal from the other terminal. Through signal processing, the terminal's own signal is cancelled (removed) thereby leaving the desired signal to further process.

The net result is that a full duplex circuit occupies only half the bandwidth it would without PCMA. This is illustrated in the figure below. PCMA doubles the bps/Hz density of a full duplex satellite link - independent of the waveform used.


Normal FDMA
W Hz
W Hz
f$_1$
f$_2$
PCMA
W Hz
Both carriers on same frequency
f$_0$

In theory, PCMA would "perfectly" cancel the original signal transmitted at each terminal. In practice, of course, the cancellation is not perfect. This results in the situation shown below.


Magnitude
Frequency
X dB
Unprocessed Downlink "Own" Signal
Suppressed "Own" Signal

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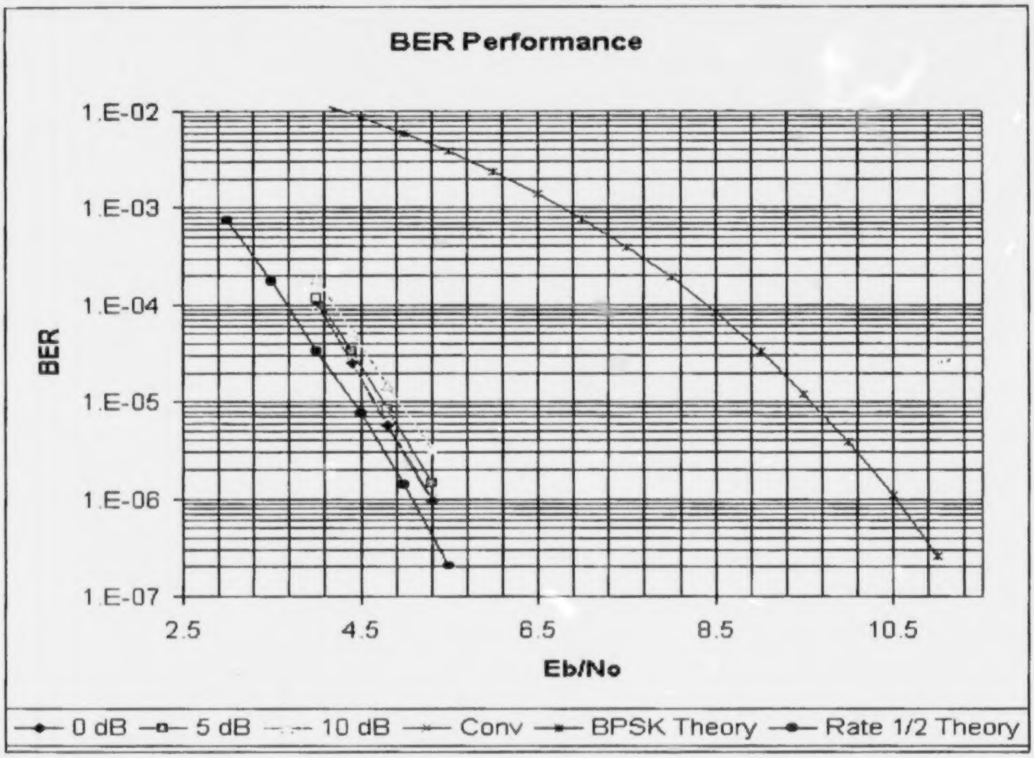
That is, each side's "own" transmitted signal is not perfectly cancelled, but is actually suppressed by some amount ("X" dB in the figure) based on the accuracy with which that terminal can estimate and subtract its signal component. The residual, uncancelled "own" signal, is an interference term (similar to other interference terms such as intermodulation distortion, for instance) that can slightly degrade reception of the desired signal from the other end of the link.

The next chart shows actual test results for a PCMA modem operating with R=1/2, K=7 convolutional coding and Viterbi decoding compared to non-PCMA performance. Three different PCMA curves are shown for three different ratios of the "own" signal at the satellite relative to the desired signal. The different power ratios at the satellite would result with different antenna sizes at the two ends of a link with a symmetric full duplex data circuit. The "0 dB" curve has virtually no degradation compared to a link without PCMA and applies to a peer-to-peer link between antennas of the same size under the same EIRP and G/T contour of the satellite.



The net result is that for symmetric services (0 dB near-far ratio) there is virtually no degradation compared to a non-PCMA modem. Even for a 10 dB power imbalance at the satellite there is less than 0.4 dB degradation due to PCMA. Degradation would be even smaller for waveforms with greater coding gain (such as concatenated codes or turbo codes).

While this result is very valuable in itself-there's an additional advantage in that PCMA can be combined with the other advanced modulation and coding techniques for even greater advantage, as will be shown in the next section.

4. Comparisons

We now use the information that we've compiled on the different modulation, coding and signal processing techniques to make "bottom line" comparisons among them.

The following table compiles data using different combinations of techniques, including:

- A QPSK reference waveform using R=1/2, K=7 convolutional coding with Viterbi decoding as well as the corresponding R=3/4 code.

- A QPSK waveform using Turbo coding.

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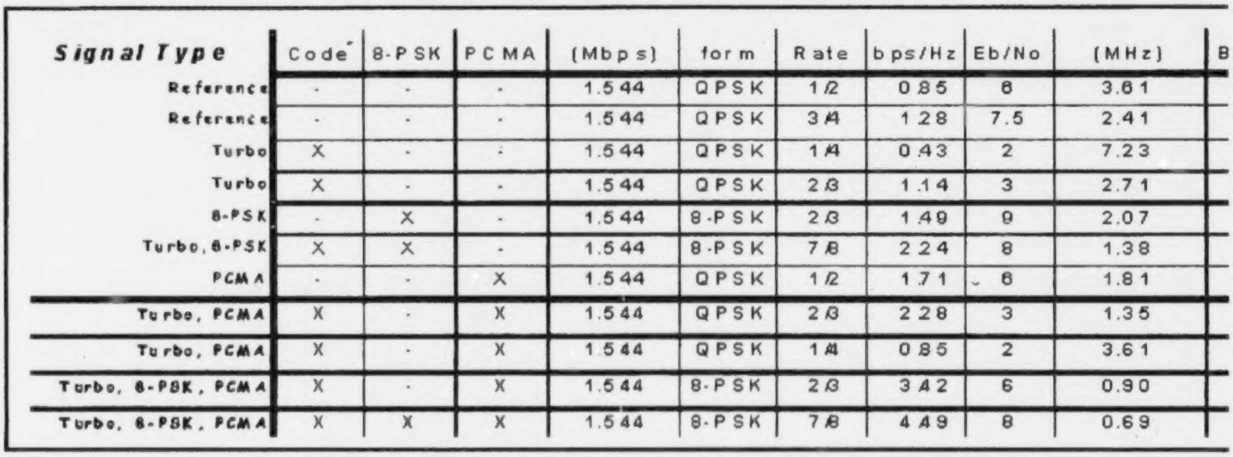
- An 8-PSK waveform using concatenated coding.
- An 8-PSK waveform using Turbo coding.
- A QPSK convolutional waveform using PCMA.
- A QPSK turbo coded waveform using PCMA.
- An 8-PSK waveform using turbo coding.

For each waveform we show the signaling type, the effective code rate, the computed effective bps/Hz, and the Eb/No associated with low bit error rate communications. We then apply each waveform to generate a full duplex T1 circuit - i.e. 1.544 Mbps point to point in each direction. Finally, we then rank each waveform in terms of its bandwidth utilization and power consumption. The waveform that has the highest bps/Hz density - and therefore requires the least bandwidth to complete the circuit is ranked #1. The least efficient waveform in bps/Hz is ranked 11th. Likewise, the signal with the lowest Eb/No requirement is ranked #1 for power, and the worst is ranked #11.



Signal Type	Code	8-PSK	PCMA	(Mbps)	form	Rate	bps/Hz	Eb/No	(MHz)	B
Reference	-	-	-	1.544	QPSK	1/2	0.85	6	3.61	
Reference	-	-	-	1.544	QPSK	3/4	1.28	7.5	2.41	
Turbo	X	-	-	1.544	QPSK	1/4	0.43	2	7.23	
Turbo	X	-	-	1.544	QPSK	2/3	1.14	3	2.71	
8-PSK	-	X	-	1.544	8-PSK	2/3	1.49	9	2.07	
Turbo, 8-PSK	X	X	-	1.544	8-PSK	7/8	2.24	8	1.38	
PCMA	-	-	X	1.544	QPSK	1/2	1.71	6	1.81	
Turbo, PCMA	X	-	X	1.544	QPSK	2/3	2.28	3	1.35	
Turbo, PCMA	X	-	X	1.544	QPSK	1/4	0.85	2	3.61	
Turbo, 8-PSK, PCMA	X	-	X	1.544	8-PSK	2/3	3.42	6	0.90	
Turbo, 8-PSK, PCMA	X	X	X	1.544	8-PSK	7/8	4.49	8	0.69	

The rankings clearly show the benefits of PCMA combined with the advanced coding techniques. The signal with the best bps/Hz density listed uses 8-PSK with R=7/8 coding and PCMA to achieve a total density of better than 4 bps/Hz! This is double the density that could be achieved without PCMA. This waveform ties for 9th in power efficiency. The most power efficient waveforms use QPSK with R=1/4 turbo coding. This variant with PCMA achieves double the density of that without PCMA. The best "compromise" waveforms are Rate 2/3 Turbo coded PCMA with either QPSK or 8-PSK (e.g., ranked for bandwidth and power 3 & 3 and 2 & 5 respectively).

5. Economic Advantages

Bandwidth efficiency and power performance are technical parameters in measuring value. Now we'll take a look at the economic incentives in fielding this new technology. Using a reasonable world-average annual transponder (36 MHz) pricing of $2.2M (US), we formulated the annual space segment cost per full-duplex T1. The results are dramatic and can be seen in the chart.

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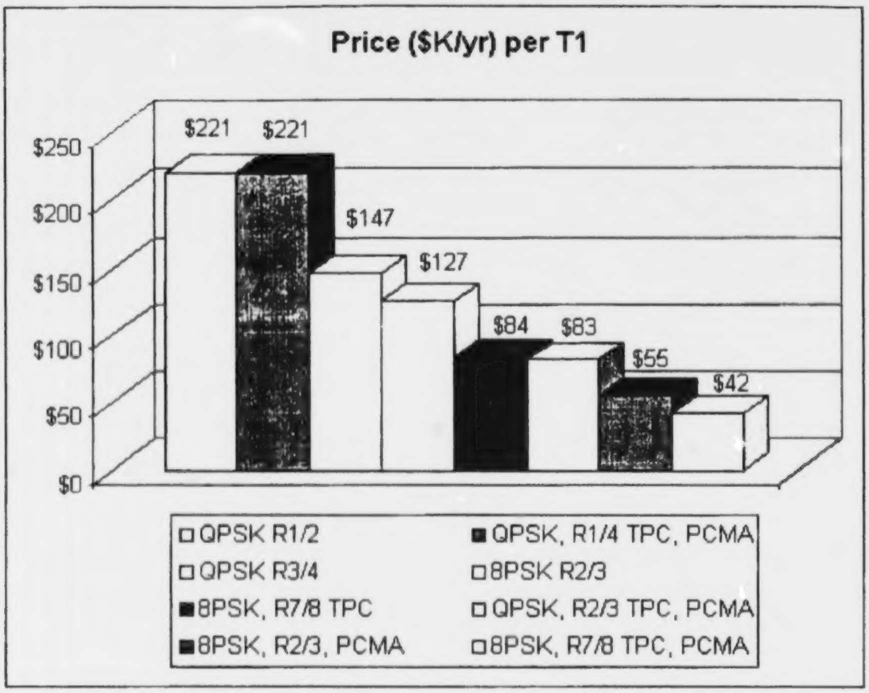

The two reference waveforms (QPSK Rate ½ and ¾) yield an annual cost of $221K and $147K respectively. When the new technologies are applied the cost drop substantially to $55K and below, translating to a 60 to 80 percent cost reduction. This substantial operational savings can open up entirely new business opportunities, as space segment costs are often 60 percent or more of the overall expenditures for service providers.

Care must be taken in evaluating cost, as bandwidth alone is not the deciding factor-power performance is a key consideration as well. Typically, networks are designed for approximately equal use of transponder power and bandwidth. And less power efficient waveforms can be "helped out" by using larger antennas (at higher equipment cost). This higher initial equipment cost can shown to be inconsequential when the resulting operational savings over a 2 or 3 year period are calculated.

6. Conclusions.

The paper has discussed the quantitative benefits of new modulation and coding technologies - particularly turbo codes, trellis coding (8-PSK), and PCMA cancellation.

In summary, turbo codes improve power limited links by decreasing the Eb/No needed to close a link and allowing more of the available C/No to be converted into useful data information rate.

8-PSK improves the capacity of bandwidth-limited links by allowing higher bps/Hz at the expense of requiring a higher Eb/No. This is a good trade for circuits that have more power than bandwidth, by converting the excess power into more throughput.

The benefit of PCMA is that it re-uses bandwidth for both directions of a circuit. This allows all of the bandwidth to be used in both directions. It allows the lowest possible coding rate - which requires the lowest possible signal to noise ratio.

The greatest benefit comes when applying a combination of these technologies. And the demonstrated results show that there can be strong economic motivation for implementing networks using these new technologies.

7. References

[1] Paired Carrier Multiple Access for Satellite Communications, Mark Dankberg, Proceedings of Pacific Telecommunications Conference, Jan. 1998.

Back to top of page **Back to the sessions page**

John Puetz

www.masterworkscomm.com (MasterWorks Communications)

John Puetz is President of MasterWorks Communications, a private company based in San Diego County, California. MasterWorks provides business and technical engineering consulting services to the global satellite communications industry and private industry. MasterWorks recently launched the Internet's first information portal, www.esatcom.net, dedicated to the satellite communications industry,.

Mr. Puetz has been in the satellite communications industry for over 15 years and has been intimately involved in the VSAT industry since it's commercial inception in 1985. He has authored numerous papers, spoken to audiences around the world and writes a monthly column and feature articles for Broadband Satellite Magazine. Mr. Puetz's fields of expertise in satellite communications include Internet access, wide area networking, VSATs, IP multicasting, rural telephony and digital audio broadcasting. He was key in the formation of the Global VSAT Forum in 1997 in which MasterWorks is an active member. He is also a member of the Pacific Telecommunications Council (PTC) and the Society of Satellite Professionals International (SSPI).

Prior to forming MasterWorks in 1999, Mr. Puetz was director of business development at ViaSat, Inc and was instrumental in launching their commercial satellite networks division. Before joining ViaSat in 1994, he worked in business and engineering roles for ComStream, Inc and for M/A-COM Linkabit from 1983 through 1989.

Back to proceeding page **Back to the sessions page**

Mark Dankberg

www.viasat.com (ViaSat, Inc.)

Mark Dankberg is Chairman, President and CEO of ViaSat, Inc. He co-founded ViaSat in 1986 and has led the company to fourteen consecutive years of revenue growth. ViaSat has been on the Inc. 500 list of the fastest growing privately held companies three times, and twice has been listed on the Business Week Hot Growth list. ViaSat went public in 1996 and is listed on NASDAQ under "VSAT".

Mr. Dankberg earned BSEE and MEE degrees in electrical engineering from Rice University. He began his career as a systems engineer in the Collins Radio Division of Rockwell International. While employed at Rockwell Collins he was also a part-time instructor in electrical engineering at Cal State Long Beach. Prior to co-founding ViaSat, he was a business area vice president at M/A-Com's Linkabit subsidiary in San Diego. There he led programs in satellite networking and digital voice communication, and helped establish Linkabit's VSAT business, which along with another M/A-Com division, became Hughes Network Systems.

Mr. Dankberg has had influential roles in establishing a number of US government satellite communications standards, including those for Demand Assigned Multiple Access (DAMA) networking, jam resistant satellite links, and satellite messaging systems. He has authored numerous technical papers on satellite networking, digital voice communication and jam resistant communications. He is now involved in developing new standards for commercial satellite networks for national and international public switched network access.

Mr. Dankberg is a member of the board of directors of REMEC, a publicly traded San Diego-based manufacturer of multi-function microwave modules and subsystems; and Connected Systems, a privately-held Santa Barbara producer of digital voice messaging network systems. Mr. Dankberg also serves as a founding member of the board of directors of the San Diego Telecommunications Council and on the San Diego County Regional Economic Task Force. He is also a member of AFCEA and IEEE and at one time was Chairman of the Communications Society for the San Diego section.

Back to proceeding page **Back to the sessions page**

Abstract

Broadband data and Internet transmissions are the fastest growing applications for satellite communications. The sheer volumes of data and the high speeds involved are increasing the motivation to get the highest data throughput possible from existing satellite transponders. The good news is that modern advanced satellite ground systems technology can make significant improvements over the prior state of the art. But, as usual, there's not a single, broad brush, solution. Different technical solutions provide the best results depending on the purpose and configuration of the satellite link. This paper considers advances in satellite modem signaling (such as 8-PSK), error correction coding (such as turbo codes), and interference cancellation techniques (Paired Carrier Multiple Access - PCMA) to show how they compare in increasing data transmission speeds and benefiting service economics.

Go to proceeding page **Back to the sessions page**

Program

☑ **Policy / Regulatory**

Monday, 15 January 2001
1400–1530

M.2.5 Regulatory Reform Processes

Chair: YOSHIKO KURISAKI, Policy Analyst, SITA EQUANT, *France*

M.2.5.1 3G Licensing in Korea: Auction vs. Comparative Selection (ABSTRACT)

WHAJOON CHO, Director and KYUYONG LEE, Researcher, Korea Telecom, *Republic of Korea*

M.2.5.2 Telecommunications and Information Policies and a New Regulatory Regime in India (ABSTRACT)

A. SUJATHA, Secretary, Center for Telecom Management & Studies and T.H. CHOWDARY, Information Technology Advisor, Government of Andhra Pradesh & Director, Center for Telecommunications Management and Studies, *Hyderabad, India*

M.2.5.3 Best of Both Worlds: A Comparative Analysis of the Universal Service Challenge in the US and Australia from a Wireless Perspective (ABSTRACT)

CHARLES D. COSSON, Senior Counsel, Public Policy, Vodafone Group Plc. Americas Asia Region, *USA* and CHRIS DALTON, General Manager, Government Affairs, Vodafone Australia, *Australia*

M.2.5.4 Calibrated Regulation: Putting to Rest the New Zealand Experiment (ABSTRACT)

GRANT FORSYTH, Manager, Industry & Regulatory Affairs, CLEAR Communications, *New Zealand*

3G Licensing in Korea: Auction vs. Comparative Selection

Whajoon Cho and Yongkyu Lee

Abstract

At the end of 19th century, Marconi invented wireless communication technology. It has been widely used for telecommunication and broadcasting for military purposes in the beginning. In most cases, therefore, request for using certain blocks of radio frequency was approved by the regulatory agency. The purpose was unique and frequency blocks were enough for demand.

For the last 10 years or so, mobile telephony has become quite popular and telecommunication service providers are suffering from lack of bandwidth. In order to avoid interruption, frequency for a certain block has to be exclusively allocated for a certain person at a certain time period. Growth of wireless telecommunications (mobile telephone and paging services) expands the demand for radio frequency, which leads to imbalance between demand and availability of radio frequency.

I. Allocation of Scarce Resources

There are three ways of resource allocation under information uncertainty; market mechanism, bargaining, and auction. Auction is defined as a mechanism that allocates goods, services, or special rights to the entity that value them properly. It is widely used in private sectors for assigning rights of mining or oil drill. Auction can be conducted in four different types; two open-bid types (English auction and Dutch auction) and two sealed-bid types (first-price auction and second-price auction).

English auction is most popular and proceeds as the participants raise their bidding amounts. When there is no higher bidding, then the previous bidder gets the assets at the price s/he bid. Dutch auction proceeds the opposite way. Auction starts with the initial price(possible maximum) and goes it down until the bidder shows up. Previous mentioned versions are conducted on an open place where all participants are gathered. Under two sealed-bid types, the participants write their bidding, sealed, and submit. After the round, the result is announced. The highest bidder gets the asset at the bidden price under first price auction, but at the second highest price at the second price auction.

Assuming bidders' risk-neutrality, probabilistic independence and information symmetry, expected returns are logically similar for the auctioneer. English auction and second-price auction are ended up with same results and the other two versions are supposed to show the same result [1].

Knowing that the major cost to the participants is that for information gathering, English auction is best. All participants are able to observe others' behavior. But it is vulnerable for collusion among participants. Several researchers analyzed characteristics of auction results. Logically risk-averse participants submit more aggressive bidding than risk-seeking or risk-neutral participants do in order to increase probability of success than others. Though it is evaluated as a transparent and efficient way of allocating limited resources, there is a logical flaw so-called Winner's Curse. Without systematic error, the average of all bids from each participant is likely to be the real value for the resource auctioned. However, the winner's bidding is the highest or next to the highest based on types of auction under operation. It means the winner's bid is naturally overestimation of real value. In other words, winner is end up in loss. This outcome denies generally accepted rationality of economic entity. In order to avoid such a situation, one has to make bid lower than his estimation.

II. Allocation of Radio Frequency by Auction

With the growth of mobile telephony, increased demand for radio frequency for commercial purposes overwhelmed the available frequency blocks. Regulatory agencies need to have criteria for selecting the entities out of all applications. Comparative hearing, lottery, and first-come-first-serve had been utilized until 1993.

Comparative hearing is criticized for taking too much time and effort. When the number of application is doubled, the time taken also has to be doubled. Since it is difficult to have clearly objective criteria for evaluation, legal cost is considerably high in case of dispute. Lottery has been introduced in 1982. The number of application increased tremendously. First-come-first-serve was used for a long time but criticism against it has been active. Like lottery, winning depends on luck or speed in taking action. It is hard for selecting the efficient applicants by those methods.

For allocating radio frequency, technological perspective has been dominant. Economical approach has been introduced at the stage of carrier selection. Herzel (1951) suggested pricing mechanism. Coase(1959) insisted that there should be property right for radio frequency when government still had a power to decide who uses the specific band for what purposes.

Though New Zealand and Australia had experienced auction in early 1990s, a well-designed frequency auction was introduced first in the U.S. in 1994. Radio Act of 1927 set up Federal Radio Communication, which had reorganized as Federal Communications Commission (FCC) according to the Communications Act of 1934. Radio Act of 1927 allows the right to allocate radio frequency used by the federal government to the President, the right for the other frequencies to the FCC. In 1993, Congress allows FCC to use auction for allocating radio frequency. Frequencies for PCS and Interactive Video Data Services were determined to be auctioned. First auction was held in July 1994. The highest bidder obtained the right.

Transaction cost can be minimized. It can be done in a shortest time period, and minimize rent seeking behavior. If any rent still exists, the government could absorb it.

In the U.S, it took about a year to design frequency auction. In order to provide various chances for selection and enough information to the participants for flexible adjustment during auction period, simultaneous multi-round auction was designed. Initial deposit for maximum eligibility, withdrawal penalty for canceling previous bidding, minimum increments, bidding rules, and spectrum cap were implemented to avoid any known disadvantages of auction.

There were limits in the number of licenses that any entity can apply for. Discount of bidding price, tax shelter, and installment payment for the bidding price were allowed for Designated Entities in order to motivate participation from certain group of people, such as women or minorities.

In October and November, for 30 licenses in 900MHz, auction ended up after 104 rounds and the government revenue reached US$ 449 million. In December, auction for 102 PCS licenses in 2GHz band was started and ended in March 1995 after 112 rounds with a revenue of US$ 7 billion, 15 dollars for each person in the area.

Oral Outcry auction was completed for 594 interactive video data services licenses in bands of 218-219 MHz, and in 1996, direct broadcast satellite licenses were auctioned.

The whole process was evaluated successful. In general, winning bid prices were similar for similar types of licenses, which means that auctions formed market prices for the licenses, one price for one good. It showed that auction was fair to everybody who participated in, and it was an efficient way to allocate frequency. Bidders were able to flexibly cope with the changes in bidding prices and bidder composition. It only took about 3 months for major area auction, and 2 weeks for regional licenses. Two rounds a day allowed participants ample time to analyze the result and make decisions. All the process was completed within a year comparing that every comparative hearing for cellular phone took about two years. Minimum increment played important role to adjust speed of auction; when it was big the auction proceeded fast. It is desirable to have high increment at the beginning and small one at the end of the auction.

III. 3G Licensing Worldwide

Comparative selection and auction are two popular methods for 3G licensing. Finland issued 3G licenses for the first time in the world in March 1999 by comparative selection. Selected carriers have to satisfy customer demand, compete fairly, be technologically advanced, provide high quality services, operate under stable and reliable condition, and set reasonable prices.

Japan issued 3 licenses for national services this year without auction, and the selected carriers will start to provide 3G services in 2001 first in the world.

First auction for 3G took place in UK for 8 weeks from April this year. Licenses are for 20 years and roaming with existing 2G and other 3G operators are required. Government collected US$ 35.4 billion for 5 licenses including the one issued out to the new entry. Radiocommunications Agency designed auction for economic efficiency, transparency and objective selectivity, and wider competition. It has 4 steps; invitation, pre-qualification, auction, and grant. The results have been controversial, and very influential to other European countries whether they consider auction or beauty contest [2].

In Germany, auction only took 14 days with total price of US$ 45.85 billion from 6 operators; T-mobile, Mannesmann Mobilfunk, E-Plus Hutchinson, Viag Interkom, Group 3G and MobilCom. Prior to the auction, qualification of each applicant was evaluated based on reliability, efficiency, special knowledge, ownership interests, and declaration of non-objection from the federal cartel office. In addition, Austria, Italy, and Netherlands decided to go for frequency auction from fall of this year to early next year.

France does not follow UK. Though it decided to use comparative selection with high contribution. Selection criteria are fast network construction for providing services to many people in wide area. Fee for a 15-year license is US$ 4.55 billion [3].

Sweden will issue 4 national licenses at the end of this year. Two out of 4 include the license for GSM network business. Selection will be made by a beauty contest after evaluating the ability for coverage.

IV. Discussion in Korea

Frequency auction was actively discussed last year, and rejuvenated this year while auction was being held in UK. Minister of Information and Communication mentioned that his ministry was reviewing it because there is no arbitrariness involved in the selection process. The government desperately requested for transparency and non-discrimination on frequency management after having hard time caused by PCS licensing under comparative selection.

The controversy over auction versus beauty contest is not unique in Korea. Auction is favored because it can select the most efficient operator and the fund raised from it is usually higher than other methods. It is assumed that the best operator expects the highest profits from the business, therefore it can submit the highest price. It is transparent and objective. There is no controversy on favor for certain applicant. It also can save time and administrative cost for information gathering and analysis and take same amount of time even if the number of applicants are increased.

The strong argument against auction comes from the uncertain business model for 3G services. No one knows how many subscribe 3G services, and which services will be provided for charge. It is hard to assess value of the frequency, therefore selection process via auction can be distorted. It simply can work as an entry barrier for that specific services. We already saw the side effects of auction in the US. The coverage, service quality, and competition are not sufficient. There is no incentives for technological innovation, some of winners were bankrupt like Nextwave [4]. Low growth in market leads to price increase, which prevents expansion of services and market. Agency problem may cause inefficiency in the process. The party who prepared application has an incentive to submit high bid to win. Since winning is more important than profit for them, the value can be assessed higher than it was supposed to be. High price for licence has bad influence on R&D investment and customer welfare. In addition, auction seems to deny public nature of radio frequency by recognizing private ownership for it. It becames a subject to corporate strategy because it depends solely on financial ability under imperfect capital market. Incumbent carriers obtain it in order to block others' entry, and/or foreign capital just hold it for economic gain from resale.

They may not provide any services, then social welfare has decreased.

Even for the British auction, some say that it will take 10 years to recover investment in 3G. When BT and Vodafone submitted the highest bid, their share prices fell down. Government is the only winner in this game if the policy was raising fund. Close Brothers Technology Group reports that it will take 20 years to recover all the investment for 3G. Monthly ARPU has to be US$150-320, four time as much as the current level, to make the recovery period short (within 15 years) [5].

Arguments are made for beauty contest, too. It releases financial burden on operator, and can minimize type 2 error, the error to select a carrier that cannot efficiently provide 3G services. It can evaluate technological and business capability, and various aspects of the applicants such as financial condition, stability, reliability of operation, and quality of services. The disadvantages involved in comparative selection are well known. The process is inefficient and criticized for special privilege. High administrative cost, lack of transparency and objectivity are mentioned. Arbitrariness or improper outside pressure could intervene in the selection process, and it is hard to check compliance to the business plan. Naturally, the incumbent has better chance to get a license than new enterant.

Even though merits and demerits of selection process are well known, controversy had been continued until July this year when the government issued Request for Proposal. Presumably high auction price could limits the number of bidding which is not good for competition, while fund raised from comparative selection can not compared with that form and information asymmetry between regulator and regulated is prevalent, thus many think that it is desirable to leave on market mechanism. Other part of the government supported for auction with belief that revenue from the auction could improve government finance more than maximum R&D contribution under beauty contest.

In order to take advantages of both methods, the government, however, declares comparative selection for 3G licensing with R&D contribution of 1 to 1.3 trillion Korean won which is around 10 times of it levied on PCS licences.

V. Business Analysis for 3G Services under Different Selection Process

Discussion on licensing methods can be understood conceptually. The validity and appropriateness of either way are not empirically examined, however. Measuring any of significant factors will clarify the focus of arguments. Based on reasonable and simplifying assumption on a few variables, cases will be set up and compared on profitability, firm value, and price for the services. It will provide valuable information to the applicants for assessing the value of 3G license, and some insight for the countries that contemplate where to go for 3G licensing.

Assumption

Base on that 68% penetration is assumed to be a saturation point, annual demand is estimated until 2010 [6]. Since it is known that there will be three licenses, equal market share of 33.3% is assumed. Unequal distribution will make cases worse in terms of profitability unless the company is dominant in the market. Usage is estimated by adjusting actual data gathered from similar services; 2G mobile voice, wireless internet, wireline data, etc. The most difficult part is the estimation of required investment. It is determined by using the unit price obtained from a vendor and the estimated subscription and usage. Network construction will be completed by 2004 to cover 98% of total population. Price is set up to cover incurred costs including cost of capital, which becomes the basis of estimating revenue. Expenses are estimated from investment in fixed assets and 2G operators' experience in recent years. In addition, total capital is assumed to be composed of equal amount of debt and equity, and the services are provided from May 2002 [7]. All these are summarized in Table 1.

<Table 1> Assumptions

		2002	2003	2005	2007	2010	Unit
1. Subscriber		566	1,504	4,673	6,223	6,871	1,000 People
2. Monthly Usage per User	Voice	109	107	105	103	100	Minute
	Video	1	3	8	10	9	Minute
	Data	21	34	60	74	80	Mbyte
3. Cumulated CAPEX		799	1,130	2,161	4,146	8,237	US$ in million
4. Cumulated OPEX		196	603	1,997	4,916	10,157	US$ in million

If there is no additional cost required either as auction price or as R&D contribution, a 3G company may be able to report net income first in 2005, and to reach to break even point in 2006. When a selected operator has to pay maximum R&D contribution and it is amortized for 15 years, life of the license, the company reports smaller net income in 2005, but it will take a year longer to reach break-even point. The cases are summarized in Tables 2 and 3, respectively.

<Table 2> Business Case without R&D Contribution or Frequency Auction

	2002	2003	2005	2007	2010
Sales	88	541	2,312	3,442	3,892
Operating Expenses	463	846	1,892	2,672	2,580
Net Income	-375	-305	420	770	1,313
Accumulated Net Income	-590	-895	-568	851	4,218

<Table 3> Business Case with Maximum R&D Contribution

	2002	2003	2005	2007	2010
Sales	88	541	2,312	3,442	3,892
Operating Expenses	584	997	2,042	2,572	2,670
Net Income	-496	-456	270	870	1,222
Accumulated Net Income	-745	-1,201	-1,173	230	3,326

The case looks worse if we assume frequency auction. In order for estimation, we had to estimate winning price for frequency auction. Some analysts published their estimation of auction price; US$ 3.64 billion by Dongwon, and US$ 3.61 billion by Hundai Securities. Thinking they are too high, we take different approach. The amount collected in the UK US$ 35.4 billion is adjusted with differences in purchasing power and size of potential market in two countries. Under that assumption, each license seems to worth for US$ 2.913 billion [8]. As you may guess, business profile looks even worse. The company is barely able to make ends meet in 2005, and break-even will take place in 2008, which are shown in Table 4.

<Table 4> Business Case with Frequency Auction

	2002	2003	2005	2007	2010
Sales	88	541	2,312	3,442	3,892
Operating Expenses	761	1,217	2,256	2,666	2,782
Net Income	-673	-677	56	776	1,111
Accumulated Net Income	-970	-1,647	-2,053	-950	2,090

The equity prices are estimated on three different cases with 4 different levels of cost of capital. It is assumed that 100 million shares are issued and outstanding. Table 5 wraps up the previous results with equity price estimation.

<Table 5> Comparison of Cases

		BEP	Paid-in Capital (milion$)	Equity Value per Share($)			
				WACC12%	13%	14%	15%
Comparative Selection	Without R&D Contribution	2006.10	406	58	50	44	38
	R&D Contribution of $1.182billion	2007. 8	1,016	22	19	16	14
Auction	Auction Price $2.913 billion	2008.11	1,909	11	9	7	6

The additional burden of auction price on operators is significant. Users have to pay increased price by 18.7% if

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the company wants to reach break even in 2006, the year that no additional cost case reaches to break even. Thus far, we fixed price and requested investment for the sake of comparison and simplicity.

The case will be worse if the price increase really happens, which is very likely. Market cannot grow as we estimated, and the actual business profile will look very bad. Even if there was a slight change in demand, the business case does not make much sense. Table 6 summarizes what it looks like if the demand is 10% less than previous assumption. No reasonable operator would be interested in new services.

<Table 6> Business Case with Maximum R&D Contribution(Worst case, demand decrease by 10%)

	2002	2003	2005	2007	2010
Sales	81	495	2,118	3,162	3,574
Operating Expenses	579	971	1,948	2,343	2,499
Net Income	-498	-476	171	819	1,075
Accumulated Net Income	-747	-1,223	-1,341	-109	2,617

Korean government recommends sharing facilities to the candidate operators, and it can save some required investment. But it is not quite clear because technical standards are not determined yet.

VI. Conclusion

For innovative 3G services, various methods of licensing have been actively discussed in Korea. Various parties prefer comparative selection to frequency auction, though. Many worry about to observe winner's curse, and low or no motivation for R&D. In addition to difficulty involved in value assessment, difference in financial ability and technology advancement is mentioned. If the licenses will be issued by frequency auction, candidates could be only conglomerates and/or international enterprises that could raise such a huge fund. Operators that cannot raise such huge amount of money is excluded regardless of expertise and/or advanced technology. Conglomerate with widely diversified lines of business can peruse profits as a group by submitting high auction price for frequency. For example, though 3G services are not able to generate enough revenue to cover costs, equipment and advertisement could do well enough to cover losses in 3G services. In a word, cross subsidy among companies in a group can be taking place. Some are even afraid of influx of foreign capital, since it could be threat to domestic vendors. Active merger and acquisition is expected because financial burden for the auction may be too big for a single company to bear. Too much spending on auction leaves not enough room for investment in infrastructure. Moreover, we did not have enough time for designing frequency auction and public nature of radio frequency was emphasized. In fact, 70% of 3,067 participants were against the auction in the Internet survey done by National Assembly.

Quantitative analysis for the business cases brings in similar conclusion. The auction put a great burden on operators and increases price for new services very likely. Rather than introducing frequency auction, we had better think about complementary measures to cure problems in comparative selection. Conditional licenses for limited time period and/or reasonable level of R&D contribution are implemented. Such an adjustment is better for customers as well as operators as seen in section V. Conditions could be different case by case, but the logic underlined licensing mechanism is common to other countries.

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Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Yong Kyu Lee

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Back to proceeding page   Back to the sessions page

Telecommunications and Information Policies & A New Regulatory Regime in India

A. Sujatha and T.H. Chowdary

Abstract

1. Old order changeth but yields not easily:

In no country in the world excepting in Sweden has the incumbent telecom operator facilitated the end to its monopoly and the emergence of a competitive regime for telecommunications . Just as in the UK, France and Germany in India telecommunications workers' unions have been waging serial strikes and the populist politicians have been running with the hare and hunting with the hound alternately speaking for liberalisation and end to government monopolies and at the same time reassuring the unionized employees that government ownership and preeminence would continue in every sector of telecoms . Almost every objective of the State policy of a socialists pattern of society delivered by government servants has remained unattained for more than four decades. In telecoms self reliance, self sufficiency, state of the art technologies, extending telephones to all the over 600,000 villages, installing telephones on demand and improving the quality of service (QOS) have though repeatedly promised, were never realised in practice. In fact, India's ace cartoonist Mr. Laxman once wrote a cartoon.

"Who says I forget my promises . I made the same promise at the time of 1952 elections ; in 1957; 1962 even last year and I am making the same now also !" .

The persons making the promise is a typical Indian politician at election meeting.

2. Drivers of Change: By 1991, India's enchantment with socialism ended with the collapse of the former communist USSR. The *manthra* of liberalisation and de-monopolisation (de- regulation) came to be chanted by the political class excepting Stalinist, Marxist, communists who have *grown* to nine different parties as the popular vote declined from 10% in 1957 to under 4% by 1999. Even government officials who have been the staunchest defenders and promoters and practitioners of socialistic *people-oriented* policies have come to sing the song of liberalisation, de-regulation, competition and private sector investment . Beginning in the late 1980s, the totalitarian control over telecoms - R&D, equipment manufacturer, investment in network and provision of services, formulating of policies, licensing, regulation and arbitration came to be questioned . Tentative moves by executive orders led to the total de-monopolisation of equipment manufacture by 1992. Suddenly equipment shortages disappeared as scores of private companies began production, some in collaboration with foreign companies But the stubborn persistence of uncleard applications for even the plain old telephone services (POTS) at between two and three million for year after year was uncomfortable. The liberalization of other sectors of economy and the end to the permit-license-quota system of economy and industry was hurting the Indian businesses, trade and commerce because of inadequate telecommunications and unavailability of new services like FAX, mobile telephony, radio paging etc. The key issue was capital investment . Could it come from internally generated resources by repeatedly increasing the rates and charges for the small base of subscribers or could it also come from domestic and foreign private investors.

3. National Telecom Policy- 1994: In 1992 government decided that every service like radio paging and cellular mobile telephony and E-mail that did not exist should not be provided by the incumbent government Department of Telecommunications (DOT) but should be provided by at least two competing private sector companies with obligatory foreign equity participation to be licenced. The DOT itself and its telephone corporation, MTNL (for service in Delhi and Mumbai) should put all their investible funds in confine themselves fixed wired telephony only. Even this did not relieve the growing waiting list for POTS. Senior ranks of officers as well as the ideologically oriented employees unions were opposed to the birth and growth of the private sector telephone companies (P-Telcos) which can be effective only if there are inter -connections when and where wanted and insufficient measure at prices that are not prohibitive. The liberalisation policy of the government was to be implemented by the incumbent DOT itself which will be the licensor of its rival companies. The reluctance obstruction and obfuscation evident for long within the DOT were sought to be over -come by the government by bringing in a non-technical civil servant (who has no unbreakable bonds and indissoluble loyalty to any one department) to head the DOT. The result was the National Telecom Policy of 1994 (NTP 1994) . NTP-'94 for the first time committed the government through the Parliament of India for across -the -board de-monopolisation ; even the basic fixed telephony was also thrown open to competition from P-Telcos. But the original wrong decision to entrust the implementation to the all -in -one DOT continued in the hope that the new civil servant head of the DOT would be able to ensure fair and speedy de-regulation including licensing rival companies. More than three score licenses were issued to P-Telcos . There was however, the pernicious principle for the award of licenses namely, *the highest licence fee and not the lowest price for a basket of services as the prime criterion for awarding licenses* . The licence fee (which were fantabulous) was to be paid as soon as the licence was issued - no matter whether the licence is implemented or not; whether there were any subscribers or not and whether there were any revenues or not. Many other one -sided inhibitive and costly conditions were also part of the licence agreements. Unlike the DOT's initial expectation (that was one of the reasons for the bidding route DOT adopted to licence) that the licence fees would come to it for its use, the huge fees went to the budget of the government . There only meant extra costs to companies, factored as higher prices to customers of the P-Telcos. Despite demands that licensing and regulation should be separated from the incumbent operator, a statutory regulator was created in 1997 only after all the licensing was completed, (early 1996 and not before). The plea that the incumbent operator should be corporatised so that there would be a level playing field between the government DOT/MTNL and its rival P-Telcos and both of them could be disciplined, over -seen and regulated in an equal measure by the Telecom Regulator Authority of India (TRAI) has not been conceded until now (government has resolved to constitute its telecom operations into a state-owned corporation , the Bharat Sanchar Nigam Limited by 1st of October 2000). While by 1996 licences were issued and P-Telcos rolled our mobile telephony, radio paging, e-mail and VSAT based private data network, services from 1997, licensing basic telephony became difficult. The DOT contrived three rounds of licensing , rejecting the some of first round bids saying that they were not high. Not finding enough bids in the second round, it lowered the *reserved amounts* (floor bid) and went in for a third round of bids, even which did not produce any bidders for many States. In the event, out of the 21 licences put up for bidding, only six could be awarded and of these only three winners went ahead with the implementation. All the P-Telcos encountered one difficulty - *no investor and no bank found it attractive to finance the business plans of the P-Telcos because they were convinced that the high licence fee payable upfront would make every company financially sick*. This in fact has become the real experience . By 1998, every company defaulted on the payment of licence fee and some companies did not even implement the license preferring to incur penalty (not yet paid) to seeking and sinking more money and loosing all. All the P- Telcos petitioned the government and lobbied public opinion and legislators for revising the licence fee conditions.

4. I.T & the Bench-mark Internet Policy: In 1998, a new government led by a nationalist party with a fundamentally new economic, social and cultural philosophy came to power. It holds that information technology and software would be the engine of India's economic development for more than forty years it has been opposing state-capitalism (called socialism) and monopolies . It adopted an IT Policy recommended by a National Task Force (NFIT) it constituted within weeks of coming to power. The highlight of that policy is that state monopoly over Internet service should immediately end and that there should be unlimited number of Internet Service Providers (ISPs); there would be no entrance or licence fee and that private Internet Service Provider (PISPs) could deploy wireless in the local loop (WLL) to connect customers to their points of presence and that they could put up their own international gateways for connection to global Internet backbones, either through satellites or submarine cables. This liberal ISP policy of 1998 contrasted with the crippling NTP -94 as implemented . Government accepted t the plea of the P-Telcos for a bail out .Over the obstruction and opposition from the DOT the Prime Minister led decided that all the P-Telcos licenced under the NTP- 94 *should be migrated from the heavy upfront licence fees paying conditions to revenue sharing and that the revenue - share should be decided by the TRAI*. This is one of the oldest and most liberal decisions that the new government took despite a cacophony of calumny and populist criticism like the nation having been put to a loss of billions of dollars of licence revenues (how they would come form dying companies did not bother the critics) all to the benefit of capitalists, domestic and foreign !

5. New Telecom Policy - NTP'99: It was soon evident for the new government that its liberal Internet policy cannot be implemented by the PISPs because the basic telecom infrastructure was not forthcoming due to the illiberal and restrictive and obstructive attitudes of the incumbent. The government took note of the rapidly unfolding convergence of computers, communications and broadcasting and as also between the fixed and mobile telephony. It realised that there would be distinction between a telecom infrastructure (an electric - photonic transport system) and the services that could be rendered over this infrastructure. Also was it becoming aware of the senseless ban on Internet telephony as imposed by the incumbent. The result was the need to rewrite the NTP-94 India has now an NTP -1999. The highlights of the NTP- 99 are :

- There is distinction between infrastructure and services . All utilities like the railways, gas and electricity companies which have rights of way and some internal communications systems can all just by registration provide telecom transport on optical fiber cables and microwave radio systems for any service provider.
- The monopoly of the incumbent over domestic long distance(DLD) should be ended during year 2000 itself . Despite the opposition of the incumbent and not so liberal recommendation of the TRAI , *government decided there could be unlimited of competitors for the DLD.*
- There would be no bids for award of licences. There will be only an entry fee and a revenue share.
- Universal access will be funded by all licensed operators including the incumbent, contributing a certain share of their revenues for this purpose. The untelephoned villages (200,000 out of 600,000) would be given a public telephone by year 2002 (the target once was 1998, then 2000 and now 2002) from this fund . It will also be utilized to give certain categories of rural and remote area telephones at below cost prices.
- International submarine cable systems can be landed at any Indian coastal town in partnership with any private telephone / ISP company , ending the monopoly of the State-owned VSNL for this purpose.
- Indian software and Internet companies can lease satellite transponder or submarine capacity from any provider and not only from Indian owned INTELSAT
- Foreign companies can have 100% equity in Internet and e-commerce services.
- The telecom operations of the government DOT will be corporatised by 1st October 2000. It will be subject to the regulation of the TRAI without any privileges or reservations in relation to the P-Telcos.

6. Broad-casting too liberalized: In the matter of broadcasting also government has taken decisive and revolutionary liberalisation measures.

- The former ban on Indian companies from uplinking their programs to the satellites from within India had been removed. Earlier they had to send their programs on tape or telecom lines to foreign countries (Sri Lanka , Nepal , Hong Kong and Singapore) to be uplinked for transmission to cable TV head ends for distribution in Indian cities for Indian audiences. Any body can now set up an uplinking facility and that could be shared by different satellite / cable TV broadcasters.
- Government has been licensing five and more FM channels for every city to private broadcasters . There

are however two unreasonable conditions .

- The bidder of the highest licence fee is given these channels just like the telecom licence under NTP - 94. There is a every likely-hood that there would have to be a bail-out and repeal of this condition, just like NTP-94 P-Telcos.
- The private companies cannot have news and current affairs on the channels. This appears to be totally senseless because such a condition is not there for private satellite TV channels.

7. Regulation:

7.1 Just as the telecom policies are being quickly revised and had been initially obstructed , independent regulation traversed the same evolutionary path. The Indian Telegraph Act 1885 (ITA 1885) still governs the telecom regime in India . It has a section which allows government to licence private and any non-DOT government enterprises to provide public telecommunications . That law of 19th century would never could think of consumer welfare or citizen's right to information; independent regulation; public consultation and such modern day ideas. When in 1986 government constituted the local telephone services of Mumbai and Delhi (together 26% of India's phones then) and India's international telecommunications into fully State-owned corporations, MTNL and VSNL respectively, they too had been given licence. No conflict could arise (there could be inconsequential disagreements) because both were owned and controlled by the DOT itself). Then too regulation was not an idea . The disagreements were within the family and would be resolved, in the final analysis, by the Minister himself.

7.2. The entry of P-Telcos with obligatory foreign P-Telco participation by way of equity between a minimum of 10% and a maximum of 49% brought up the question of independent regulation insistently . The incumbent operator being the licensor and the arbitrator (in terms of the ITA 1885) did not want to lose its untrammeled power over which way and what extent and in what areas the P-Telcos would be tolerated. The DOT was at pains to assert that the NTP- 94 envisaged the *P-Telcos only to supplement the DOT's* efforts and not to supplant it or to weaken and destroy it. That is why although repeated representations even on behalf of foreign governments were made to constitute an independent regulator separate from the licensor operator, *the DOT postponed such a measure until it got every P-Telco to sign on the license agreement it has drafted unilaterally and only thereafter, that is, in 1997 it constituted the regulator - Telecom Regulatory Authority of India (TRAI).*

7.3 It was the Minister who nominated the Members. All these happened to be retired civil servants including a retied Chief Justice of a State's High Court as its Chairman. The TRAI law has clauses which ensure the predominance of the Indian Telegraph Act 1885 in very crucial matters like government giving directives to the TRAI and the meaning of the words in the ITA 1885 having definitive power over every word used in the TRAI Act.

8. Trials of the TRAI-'97: From the beginning the TRAI had to face adversarial relationships between DOT and the P-Telcos and between itself and the DOT. On appeals made by the P-Telcos in regard to interconnection, rates that the DOT was charging to its customers for calls to the P-Telcos' customers and the sharing of such call revenues were all mattes of contention on many of which the TRAI had given decisions against the incumbent DOT. Then the DOT argued that the TRAI has no jurisdiction over dispute between the licensor (its role in addition to being an operator) and the licensed P-Telcos. It dragged the TRAI before judicial courts. In another case relating to the distribution of revenues on calls from the MTNL to the mobile P-Telcos also the MTNL/ DOT challenged the jurisdiction of the TRAI in the civil courts. Not satisfied with this, the DOT planted the senior- most Executive of the operator DOT as a member of the TRAI along with two more retired civil servants. The TRAI of 1997 thus came to be trivialized with these measure and thereafter came split decisions. Its functioning came to a halt. That was by the middle 1999 when the Prime Minister himself had to intervene to bail out the P-Telcos and when he was engaged in formulating the NTP-99. The bureaucracy in the DOT was so powerful that it "*nationalized*" its Minister even and the Prime Minister had to shift the nationalized (departmentalized) Minister and take charge of the Ministry himself directly. But he could not interfere with the civil courts which decided against the TRAI vis -a-vis the licensor DOT .

9. Regulation 2000: In the event, the government had to dissolve the TRAI itself and bring in a new two-tired system for regulation and dispute resolution. This was done by an ordinance which was later ratified into law. So the second generation regulation now comprises of :

a) A new TRAI (2000) whose jurisdiction in regard to rate -setting and obligatory consultation on the degree and conditions of competition have been conceded to the regulator . It however has no concern over disputes between the licensor and a licensee. The operator DOT and the government companies have been unambiguously brought under the regulation of the TRAI without any privileges .

b) A new body, Telecom Disputes Settlement And Adjudication (TDSAT) was constituted for resolving the disputes between the licensor and the licensed companies.

10. Regulation and Customer: In the nearly four years of independent telecom regulation in India, *the important matter of consumer welfare has not been adequately addressed*. The disputes between the P-Telcos and the incumbent DOT and contentions between the licensor and the TRAI had taken much of the time and labour of the TRAI. It has however initiated wholesome procedures for consultation with public in open meetings, in different cities of the country . It took upon itself the task of *aligning prices towards costs* . This was a major exercise. In the first round, it reduced the rates for DLD and international calls but increased rentals and local call charges in effect by reducing the 5 minutes for unit charge to 3 minute for local calls. In a second round revision in August 2000, it further reduced the DLD and international call rates.

10.1 In the most important area of quality of service public hearings were held and the TRAI has determined the parameters for QOS. *But it has not yet determined the waiver of rentals and charges penalties and compensation and damages for deficiency of service* . This is of great concern to consumers.

11. Convergence and Regulation 2000: In the year 2000 government created the new Ministry of Information Technology (MIT) by upgrading the former Department of Electronics (DOE) and entrusting it with the fashionable mission of promoting internet and e-commerce in particular and informatisation of the society and electronic government every where. Now there are three ministers dealing with essentially the same object; namely information. These are the more than a century old Ministry of Communications (MOC), the more than 70 years old Ministry of Information and Broadcasting (I&B) and the youngest Ministry of I.T. Cable TV networks are allowed to be utilized as access providers; that is, connecting customer to telephone network and to the Internet. They are also allowed to become Internet Service Provides (ISP). The responsibilities as well as jurisdictions of the three ministries are overlapping and there is great potential for mutual strife. Obviously, the convergence of communication, computers and broadcasting will go on accentuating the potential for strife between different ministries having jurisdiction on essentially the same thing, but in parts which are shared eg: electronic/photonic transport. Therefore, one of them the Minister for I&B has already drafted a convergence bill. Also is there a draft for a new Telecommunications Act. Both of them owe their inspiration to the most informed and active of the three ministers. He has even drafted and crafted a new super regulator for Information Communication and Entertainment (ICE). That bill envisages the incorporation of the TDSAT and the TRAI as bureaus of the proposed super regulator of ICE. Another bureau would be for radio frequency spectrum management. A fourth one will be for content (in broadcasting over the air and on the cable and the Internet) .

12. Erring and Learning: It is obvious that the Indian telecom (and information) policy and law makers are under great strain because the technology is obliterating the distinctions between separately born services and undermining the monopoly and the old idea of licensing telephony as intrastate, interstate, and international separately ; mobile and fixed telephony separately; Internet and e-commerce yet more separately. Also is there the ban of the DOT on voice over Internet while its implementation is impossible already . The European Economic Community has put in prolific work drawing the best brains from all the member countries, conducted consultative conferences and debates before arriving at the present totally liberalised regime for ICTs. India is only reacting to the avalanche of technology and services that are descending upon it. *It is averred that irrespective of what the laws are, technology would prevail and since the current mantra is not socialism and State control but free enterprise and competition,* like the cable TV a decade ago having been established "*illegally*" by tens of thousands of individual enterprises , new information services which includes telephony would also be first established and laws will follow to grand -father the facts. It is human frailty almost everywhere that it does not learn from history and does the rational only after trying everything else but then as philosopher Santayana said, " *those who don't learn from history are doomed to relive it". (3,744 words)*

Back to top of page **Back to the sessions page**

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Back to proceeding page Back to the sessions page

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> ***Are you listening?***
> (The story of his struggles in the Dept. of Telecommunications to restructure it, deliver service and not merely administer Rules)
> ***Issues in Telecom De-Monopolisation in India***
> ***P-Telcos in India-Why did India get them so wrong?***

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Back to proceeding page **Back to the sessions page**

Best of Both Worlds: A Comparative Analysis of the Universal Service Challenge in the US and Australia From a Wireless Perspective

Charles D. Cosson and Chris Dalton

Abstract

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I. Introduction

This paper analyzes, in a comparative way, how the United States and Australia - two large democratic and industrial companies on opposite sides of the Pacific - are coming to terms with similar issues regarding competition in local telephony and the role of universal service programs. Universal service programs are taxation schemes that, through varying degrees of regulation, assign costs to, or assess fees on, certain services in order to subsidize more affordable rates for other services. This is, obviously, an extraordinary distortion of the market but one that is felt to be necessary because of the high cost of service in rural areas and the benefits of maximizing initial network connections and basic service usage by consumers. If basic service prices were set at levels that recovered their full costs, many citizens would find basic service unaffordable and, in turn, the value of the service would decrease because there would be fewer customers available for calling. Thus, regulators intentionally cap the price of basic services at a level below the carriers' costs and make up the difference elsewhere. As a general matter, it is not the practice of making basic service affordable that is controversial but, rather, the "elsewhere" from where the carriers's costs are recovered.

When prices for basic services are capped by regulation it means that the Government must make policy judgments - which are, in reality, political judgments - about (a) the basic service package to which all consumers have a right of access; (b) at what 'affordable' price consumers should have access to that service. From a mobile carriers' perspective, it is critical that policymakers focus on ensuring that universal service programs are effective yet efficient. Wireless providers are likely to be net payors into any universal service program, and have an interest in seeing competition grow among the wireline local carriers with whom they interconnect.

There was a time when it was thought that wireless carriers might well become providers of basic voice service and become recipients of universal service subsidy revenues. While it is still important that programs afford wireless carriers that option, it is becoming increasingly obvious, however, that the future of mobile services does not necessarily lie in providing basic voice services in competition with wireline carriers, but in a separate, complementary market for Internet and data services. For one thing, the regulatory oversight involved in the provision of subsidized "universal services" is simply too obtrusive for mobile carriers to find it worthwhile. Moreover, the entire point of subsidized provision of basic services is not to make those services so profitable that they attract new network investment, i.e., to generate competition, but rather to make them only profitable enough that the providing carrier recovers the ongoing costs of doing business.

Moreover, the recent financial performance of the major long-distance carriers is strong evidence that competitive provision of voice traffic services will fail to generate sufficient profit margins to justify new investments or, perhaps, even to attract enough capital to keep the business alive as a going concern. All telecommunications carriers will, it is expected, be obligated to find new revenue sources through the provision of Internet and other data services. And as this business evolution moves forward, wireline and wireless services are likely to provide very different, rather than substitutable functions. Mobile handsets have small screens that do not lend themselves to full-motion video, while desktop PCs are less useful for making restaurant reservations, confirming flight times, or reading e-mail while on the move. Different content formats and bandwidth constraints will all act to keep the product markets of wireless and wireline services separate and distinct.

Accordingly, policymakers who may have formerly been interested in universal service programs that enhanced the ability of wireless carriers to compete for local telephone minutes are now turning to new problems. Universal service issues that now require attention have less to do with promoting a role for mobile carriers as wireline competitors than they do with addressing two basic problems: 1) how to preserve and encourage competition by keeping the level of subsidy flows from competing carriers to incumbents low; 2) how to nevertheless expand the effectiveness of universal service programs to ensure that urban/rural or wealthy/poor disparities are not exacerbated in the race to the digital Internet age. This article describes, in turn, how Australia and the United States are coming to grips with these two important issues.

II. Background on Universal Service Policies and Programs in Australia and the US

A. Universal Service in Australia

1. Universal service regime design

The Universal Service Obligation (USO) regime in Australia is designed to ensure that all people in Australia, wherever they reside or carry on business, should have reasonable access to the standard telephone services and other prescribed services [1]. The standard telephone service is a carriage service for voice telephony. It has recently been upgraded to include certain digital data services (96% of the population must have access to an ISDN equivalent service). For the remaining 4% of customers in remote Australia there is a capped subsidy paid to them for acquiring equipment to provide access to an asynchronous satellite based data service. The Australian government has recently issued an invitation for carriers to lodge tenders for a $150m grant to provide untimed local calls in "Extended Zones" and be the monopoly USO provider in these areas. Because of their remoteness customers in these areas currently don't have access to untimed local calls but instead have 'preferential rates' - where the first 10-12 minutes of a call within a defined region are at a flat rate, then additional minutes are charged on a per minute basis. At the last election the Government made a commitment to give these customers equity with the rest of Australia with regard to untimed local calls - and would fund this with $150m from the second tranche of Telstra shares.

In Australian public policy, the principle behind USO funding arrangements is similar to that understood in the United States: that it is competitively unfair for a commercial organisation to have to bear by itself any losses it incurs in meeting unique license obligations that have been imposed on it by the Government. Price caps apply to the basic voice service and as a consequence the carrier legally obliged to supply that service (currently Telstra) may only be able to do so at a loss. The carrier is then reimbursed 100% of these losses through a USO levy scheme. Price caps do not apply to the digital data service, so no USO payment is made to Telstra in respect of this legal obligation. The USO levy scheme is fully industry funded. Each carrier contributes in direct proportion to its share of the total telecommunications "eligible revenue". For example, suppose Telstra has approximately 85% of the total eligible revenue, Cable & Wireless Optus 10% and Vodafone 5%. Then with a USO amount of $250 million, the USO levy on Telstra would be $212.5 million, on Cable & Wireless Optus $25 million and on Vodafone $12.5 million.

2. Determining the USO amount

The USO amount for a year is currently calculated to be the amount by which avoidable costs exceed revenue foregone in meeting the universal service obligation. Broadly speaking, avoidable costs are the amounts of operating costs, depreciation and opportunity costs of capital that would have been avoided if the loss making USO services had not been supplied. The revenue foregone is the revenue that would not be received if the services had not been supplied.

Avoidable cost estimates are calculated on the basis of the most cost-effective technology and production practices that are available and suitable. For example, carrier costs are based on forward looking technologies of service delivery, using best practice engineering rules, regardless of the existing means of delivery and embedded facilities and equipment. In this sense, the historic costs of the USO provider are not the basis for deriving the costs. Rather, the basis for deriving the costs are those that would be borne by the most efficient operator in delivering the stipulated services and represent the true opportunity cost of meeting the USO. The costs developed to service the net loss areas should reflect the underlying "greenfield/scorched earth" assumption - in the absence of the USO, Telstra would not service the net loss areas.

A cost proxy model is used to determine the USO amount. As the USO scheme in Australia is fully industry funded, the principles for the design of the cost proxy model had to be agreed between Telstra, Cable & Wireless Optus and Vodafone, working with the industry regulator, the Australian Communications Authority (ACA). The United Sates based company Bellcore International Inc was then contracted to build the model - "the Bellcore model". The model thus provides the only means for carriers other than Telstra to control their USO related costs. Telstra on the other hand, as the USO provider, controls the actual costs it incurs and revenues it receives arising out of its USO obligations.

3. History

Up until the introduction of competition in the supply of telecommunications services in Australia (1992) through the market entry of Vodafone and Cable & Wireless Optus, Telstra absorbed any losses incurred in meeting its USO obligations. Then, based on estimates calculated by the Government's Bureau of Transport and Communications Economics, an interim USO amount was set (approximately $250 million), with the agreement of all industry players, pending the development and implementation of the Bellcore model. The Bellcore model was used for the first time for the 1997/98 financial year, when Telstra lodged a claim in October 1998 for $1.8 billion to cover the losses it incurred in 1997/98 in meeting its universal service obligations.

This immediately provoked a strong response from industry, on the basis that Telstra's claim was grossly overstated. Early in 1999 Vodafone and Cable & Wireless Optus both estimated the correct USO amount was less than $300 million. There was then extensive industry consultation by the ACA in its review of Telstra's claim, leading to an assessment by the ACA in October 1999 that the USO amount for 1997/98 was $550 million, with a 95% confidence interval of +/- $71 million. Since then, the ACA has estimated the USO amount for each of 1998/99 and 1999/2000 to be less than $300 million.

4. Adjustments to Telstra's USO claim

Three main factors were responsible for the substantial reduction in Telstra's claim - accounting practices and assumptions; use of new technology; and reduced infrastructure costs. The most significant of these was the value used for the Weighted Average Cost of Capital (WACC). Telstra's claim was based on a WACC in excess of 16%, whereas the ACA (based on advice from financial experts) assumed a WACC of 11.2% for the 1997/98 claim, 7.2% for the 1998/99 claim and 8.5% for the 1999/2000 claim. The difference between 1997/98 and subsequent years was that for 1997/98, for legal reasons, the ACA could not take into account Telstra's USO levy receipts, whereas for the two subsequent years it could. This single issue was the subject of very extensive scrutiny and debate.

The ACA also engaged technical experts to provide independent advice on technology costs. The ACA adopted their recommendations that satellite and wireless technologies could be used for service delivery (Telstra's claim was based primarily on cabling solutions and a very limited use of Digital Radio Concentrator Systems), at a considerably reduced cost to that estimated by Telstra - for one service Telstra estimated an annual loss of over $80,000! The use of such technological models to determine the amount of actual operating loss for which Telstra should be reimbursed is, obviously, very controversial. Other contentious issues arising out of the assessment of Telstra's claim were the value that should be placed on intangible benefits (such as the revenue from value added services, and ubiquity) and the inadequacy of an extremely small sampling base from which all cost and revenue estimates were derived. The ACA assumed a zero intangible benefit, as it was unable to make an accurate estimate.

B. Universal Service in the United States

1. History

In the United States, 'universal service" as a regulatory concept arose out of the ashes of a long antitrust battle. In the 1890's, Alexander Graham Bell's patents expired and a number of local telephone companies arose. These companies did not necessarily, however, connect their networks to each other, nor were they necessarily connected to the Bell System's "Long Lines" network that permitted inter-city calling. In fact, the Bell System pursued a systematic policy of denying interconnection to these facilities and leveraging that situation to its advantage. In this manner, the Bell System bought out a substantial number of the independent operators. This, unsurprisingly, attracted the attention of antitrust enforcers emboldened by the passage of the Sherman Act antitrust legislation only a decade before. The resulting settlement, known as the "Kingsbury Commitment," required the Bell System (known by this point as AT&T) to cease acquiring independent companies and to provide interconnection to the Long Lines network.

But its effect did not last long [2]. Intervening events, particularly the first World War and the Great Depression, would make the horizontal integration of a nationwide phone network an accepted public policy arrangement. The premise for excluding competition was largely the product of an astute businessman, Theodore Vail, who convinced regulators and antitrust authorities that a fully integrated telephone network, subject to state and federal rate-base regulation, would more likely yield public benefit than competing networks and the attendant "wasteful duplication." From Vail's perspective, regulatory protection would establish the Bell System as a monopolist while avoiding the uncertainties of antitrust enforcement.

From the perspective of public authorities, a single telephone system could more easily be held accountable to public purposes and more easily policed-as Caligula had once wished Rome had but one neck. Moreover, a regulated monopolist could more easily be required to set prices in a manner desired by the government and invest in facilities at directed locations. Thus, the policy of excluding competition became synonymous with the term "universal service." [3] Intra-company subsidies, from long-distance to local services and from business to residential services, were used to keep basic local service prices low; often below their actual costs. Surprisingly, given the advances in technology that would follow, this approach to universal service would exist in more or less the same form - with the addition of a few measures to enhance the program for rural carriers or to improve incentives to keep costs low - until 1996.

2. The 1996 Reforms

The 1996 Telecommunications Act directs the FCC to review universal service arrangements to make them compatible with the elimination of exclusive monopolies in local telephony. It lists hortatory goals for universal service, but the meat of its requirements are 1) the FCC must ensure that universal service mechanisms are "sufficient"; 2) it must see that universal service mechanisms are "specific," i.e., no continued internal subsidies; 3) it must provide that support is available to any carrier designated as eligible [4]. Section 214(e) of the U.S. Communications Act establishes the criteria for carriers eligible to receive federal universal service funding.

Designation as an eligible carrier is through a state regulatory commission. Under Section 214(e)(1), a carrier must offer a particular set of services, which basically encompass singe-party, touch-tone service, with a certain amount of local usage covered by a monthly service charge, and access to emergency services and interexchange calling. A carrier may be eligible to receive universal service support even if it provides these services through a combination of its own facilities and resale of another carrier's services, including another eligible carrier [5]. A carrier must also advertise the availability of such services throughout the area using media of general distribution. Under Section 214(e)(2), a state may designate more than one carrier as eligible for a given area, although it must make a public interest determination before making such a designation for an area served by a "rural telephone company." [6] Sections 214(e)(3) and (4) govern the procedures whereby a State commission may designate carriers as the eligible carrier for an unserved area, and whereby an eligible carrier can relinquish its designation. Section 214(e)(5) gives States a very important power -- it permits State commissions to establish the geographic area at issue.

Section 254 creates the procedures to review universal service requirements in light of advances in technology and market demand, and establishes principles and policies for universal service, including a definition of "universal service." [7] This section also establishes the scope of State authority to adopt universal service regulation. Under Section 254, States may also adopt their own universal service mechanisms provided any state regulation is not inconsistent with the Commission's rules, and do not burden the federal support mechanisms. Section 254 requires toll rate averaging [8], and specifically prohibits cross-subsidization of competitive services with revenues from services receiving universal service support. Finally, this section establishes special rules for schools, libraries, and rural health care providers.

Under the Communications Act, a state must designate any telecommunications carrier, including a wireless carrier, that meets the eligibility criteria of Section 214(e)(1) as an additional carrier eligible to receive federal universal service support for an area not served by a rural telephone company. The FCC has also concluded that the Communications Act precludes states from imposing any additional prerequisites for designation as an eligible telecommunications carrier. However, state commissions may impose other requirements unrelated to a carrier's eligibility, such as quality-of-service regulations. In areas served by a rural telephone company, the state may designate an additional carrier as eligible to compete for subsidies in that area, but it must first find that the designation is in the public interest.

III. Harnessing Competitive Forces to Make Universal Service Programs Efficient

A. Developing the Contestability Approach in Australia

As indicated above, Telstra's grossly overstated $1.8 billion claim provoked a very strong industry response that led to the Minister capping the 1997/98 USO amount at $253 million and then adopting the ACA estimates of $279 million and $280 million for the subsequent two years. At the same time the Minister asked his Department to start investigating ways of introducing contestability into the provision of USO services. [9]

As with many government policies, modern administrations are experimenting in ways in which the delivery of social goods and government services not provided for by pure free-market mechanisms can nevertheless be provided more efficiently by harnessing market competition. In the area of universal service, the Government is implementing a USO contestability model based in part on policy suggestions from Vodafone. Its essential features are:

Primary Universal Service Provider (PUSP)

Telstra is to be nominated as the PUSP (or carrier of last resort) in the two USO contestability trial areas. As a consequence Telstra must provide the standard telephone service on demand to anyone in the area. This obligation includes the provision of untimed local calls and meeting Customer Service Guarantee targets - essentially no change from the service customers currently receive. Telstra can also offer an Alternate Telecommunications Service (ATS), with different service features, that the customer may elect to receive in place of the standard telephone service. Telstra would receive the USO subsidy for each customer to whom it supplies the standard telephone service or that signs up for its ATS. The ACA will determine what premium is to be paid to Telstra in recognition of its unique role.

Competing Universal Service Provider (CUSP)

Any other carrier can seek pre-qualification from the ACA to be a CUSP. They can then offer a USO package (encompassing an ATS) to all customers in the USO trial area. For each customer they sign up they would be paid the USO subsidy for that customer. Unlike Telstra, a CUSP can choose to withdraw its services from a trial area.

PUSP/CUSP pre-qualification

The ACA must approve the ATS marketing plans of CUSPs and PUSPs as part of the pre-qualification registration process. This is to overcome any scope for 'cherry-picking' that might be possible if a CUSP were only to offer an ATS package that would only be attractive to high revenue customers.

Portable subsidy

The ACA will determine for each customer in the USO contestability zone the USO subsidy that is to paid to the carrier chosen by that customer to be its USO provider. These subsidies have not yet been determined, but may be at three levels: (i) remote customers, for whom the subsidy is based on satellite technology; (ii) less remote customers, for whom the subsidy is based on wireless terrestrial technology; and (iii) customers in more densely populated areas, for whom the subsidy is based on cable technology.

A major attraction of the USO contestability model is that it is demand driven. To date USO arrangements are essentially supply side models - with the primary issue being how much to reimburse the universal service provider for the losses it incurs in meeting its universal service obligations. The contestability approach only requires that the subsidy level be set sufficiently high to attract at least one CUSP. There no longer needs to be accurate modeling of cost structures, thereby avoiding the contentious disputes about alternative modeling methodologies. In addition, the onus is on the CUSP or PUSP to offer an ATS that is sufficiently attractive to the customer so as to win that customer's business (and the associated USO subsidy payment).

The consequences of this are far reaching. Among other things, the customer can exercise some choice over (a) who their USO carrier is; (b) what services they want (they may, for example, have a choice between an ATS that includes a mobile offering and an ATS that has a high speed internet access offering); and (c) the prices they pay. Also, carriers will have the opportunity to achieve economies of scope - a common GSM platform can be used to provide both the standard telephone service and a mobile service (the ACA has assessed that GSM is the most economical technology for service delivery to up to 100,000 customers in USO areas).

One might also expect that carriers will seek to maximize service offerings in order to win customers (to the benefit of those customers), compared to a monopoly USO provider that might focus on cost and service minimization. No customer need experience any service deterioration as they can elect to stay with Telstra with the same standard telephone service that they currently have. Yet, at the same time, the Government no longer needs to decide on behalf of customers what the common minimum USO service package should include - the "one cap must fit all" compromise can be abandoned.

The contestability arrangements should gain additional political viability long-term. Universal service costs will be contained. As Telstra loses market share it may acquire a net USO levy debt (currently it is the only carrier to have a USO levy credit) and have to reimburse other carriers for their USO losses. This will remove any incentive that may currently exist for Telstra to overstate its USO losses; and (theoretically), net USO payment between carriers could reduce to zero if each carrier captures the same share of the USO market as it has of total taxable revenue. The USO contestability model applies the carrot rather than the stick - a carrier is attracted to offer a USO service because of the subsidy, rather than being forced by regulatory obligation and threat of pecuniary penalties to provide a minimum level of service. It provides a good example of an incentive-based regulatory approach being used to achieve policy ends.

One implementation issue that may be contentious is the size of any premium payment to be made to Telstra for being the PUSP. There is a good economic case that there should be no premium payment. Telstra starts with 100% customers, 100% infrastructure; 100% revenue; 100% distribution arrangements; 100% customer traffic and market information; and an inherently conservative population base (in 1993 when rural customers were given the option of switching to Optus or remaining with Telstra, over 90% chose to stay with Telstra). A new entrant, on the other hand, must win customers off Telstra, invest in a new network and new distribution arrangements, build up revenue from $0 and base an ATS package on a very limited amount of market data. The commercial risk of pre-qualification for any CUSP is therefore likely to be higher than the risk of being the PUSP.

Presently, the Government has announced two areas in rural Australia where new USO contestability arrangements will be trialed (comment on these trials was received from the public on 13 November 2000, and legislation is also currently being debated in the Parliament). To date, Telstra is the only carrier that has supplied a significant level of services to these customers. The actual level of demand for new value added services is unknown and only Telstra has accurate data about traffic levels and patterns for existing services. The trial, therefore, will provide valuable market data to new PUSPs about the attractiveness of ATS packages, calling patterns, the elasticity of demand, the cost of providing services in rural Australia and the support mechanisms needed to ensure Customer Service Guarantee requirements are met. This will assist PUSPs to tailor their ATS packages to more closely meet customer demand.

Experience with the assessment of Telstra's $1.8 billion USO claim has highlighted the sensitivity of cost proxy models to the values assigned to input parameters (such as the WACC). Unchecked, the USO arrangements could have led to Telstra's competitors being needlessly required to pay over $200 million per annum to Telstra. The USO contestability model has the potential to cut through the increasingly unproductive debate over cost proxy methodologies and to avoid any harmful anti-competitive effects that might arise from their incorrect application. Indeed, the implementation of a demand driven, incentive based USO scheme has the promise of delivering real benefits to customers at an overall reducing cost to carriers.

B. Harnessing Market Competition in the United States

The United States, like Australia, has sought to introduce the benefits of market competition into universal service programs, in order to keep costs down. As noted above, Section 214(e) requires States to designate as eligible any carrier who meets the criteria, while FCC rules provide that such eligible carriers are entitled to the same per-line subsidy as that received by the incumbent, for every customer who they take away. Presently, few wireline carriers have made significant enough inroads to determine whether this approach is yet having any meaningful effect on the cost of universal service programs, and there continue to be legal skirmishes with respect to whether wireless carriers are being restricted from participation in universal service funding by virtue of discriminatory state regulations. At the same time, few wireless carriers have expressed an interest in participating as a competitive universal service provider, preferring to continue their approach of providing service on an un-subsidized, un-regulated basis.

The United States, unlike Australia, has not attempted to incorporate different technologies into the cost proxy model. Although the FCC's guidelines for developing the model called for use of the "most-efficient" technology, there was insufficient data to determine whether wireless or wireline technology was the most efficient in a given instance. Where there is some evidence - much of it anecdotal -that wireless technology is more efficient in rural areas, there is also evidence that wireless technology is equally as expensive, except when dealing with the most rural areas. Given this state of the record, costs continue to be based on a wireline model.

The United States has raised the issue of universal service auctions, which would allow the FCC to set the price of the subsidy on the basis of direct bidding - rather than the cost proxy model. A number of proposals have been submitted, some by local telephone carriers and others by academics. So far, however, these proposals have failed to address some key questions involved in how a fair bidding process could be conducted. Among these questions are: 1) how to weigh competing bids from carriers who do not offer identical service packages; 2) how to reward a carrier who submits the lowest bid - presuming that the solution is not to exclude competitive entry by carriers who bid to offer service at a higher subsidy rate.

For example, a system of auctions was proposed during the universal service deliberations that were underway at the time of the 1996 Telecommunications Act. As noted above, one reason why this has not been adopted is that it is hard to conceive of an arrangement whereby carriers bid for a non-exclusive franchise. Even if the result of an auction is that the subsidy is set at the lowest level bid, this presumes that carriers who bid for a higher subsidy would not enter the market. Therefore, the arrangement was thought to unacceptably preserve monopoies in universal service areas.

Another reason why this proposal has not been embraced by the FCC is that it would preclude funding for carriers who assumed "asymmetric" obligations. In other words, any firm applying for subsidies (whether through competitive bidding or through interim arrangements) must assume the same obligations as other eligible carriers - incumbent LECs. Thus, any eligible carrier must be subject to the same obligations to serve all customers, the same state rate regulation, and any other obligations a state chooses to impose that are not inconsistent with the Act. Even if the auction amount is continually re-bid, this hardly seems to serve consumers, who should have a choice of both price and service provider.

IV. Addressing New Universal Service Needs

A. Universal Service for Advanced Services

One of the key universal service issues remaining is what should be done to ensure that rural and low-income consumers are not left off the network in the transition to broadband data and Internet services as a primary use of the telecommunications network. Existing programs that subsidize basic voice telecommunications services will have to be upgraded if there is a demonstrable case that rural and low-income consumers are, in fact, being left on the wrong side of the "digital divide." In the United States, at least, the evidence so far is inconclusive. Given this condition, it seems prudent to wait before new taxes, subsidies or other distorting mechanisms are introduced to address the alleged "digital divide." Policymakers should not assume that, simply because there has been a need in the past to subsidize basic local services, there will be a need in the future to subsidize an expansion in the number and range of services provided..

The growth of Internet services is following a predictable trend and is now reaching mass-market status, suggesting that the "digital divide" may be small and shrinking. Some of the government studies identifying a more dramatic "divide" between "haves and have-nots" may well be much more bureaucratic self-preservation and/or election year politics than actual evidence. And, it is hard to tell the extent of the problem, since a number of factors are at work. Government programs are already underway to address these concerns.

For example, in Australia, the Government imposed a license condition on Telstra that Telstra should make an ISDN type service available on demand to 96% of the population, and introduced a new USO funded grant of up to $765 for those unable to access the ISDN service to acquire equipment to access an asymmetric satellite based data service (implemented). In the United States, the "e-rate" program provides subsidies to carriers who provide discounted services to schools, libraries and other public educational facilities. Unlike the subsidies that support traditional telephone service in high-cost areas, these subsidies are also available to providers of high-speed Internet access, mobile wireless, and other advanced services. So far, US $2.25 billion has been committed for these purposes. [10]

Other programs will no doubt continue to address the issue, but the interesting debates will come at the point when high-speed broadband Internet access and/or mobile wireless service have become so necessary and ubiquitous as to create the political climate needed to expand the scope of the services that are considered "basic" services and must be provided by carriers subject to USO obligations. The additional costs involved in expanding universal service programs for this purpose, as well as a number of complicated issues raised by the prospect of providing subsidies for a wider variety of competing technologies (e.g., cable broadband, fixed wireless, xDSL, etc.) are certain to make this a highly contentious debate.

At the same time, there are at least three "naturally-occurring" economic conditions that may make government subsidies unnecessary, as the market will drive increased investment in infrastructure for advanced services: 1) the natural operation of competitive forces building between infrastructure providers such as telephone, cable TV, satellites and wireless,2) the efficiencies in providing advanced services created by economies of scope between basic and advanced services, and 3) rapidly increasing demand, including in rural areas. The presence of these three factors suggests that it is more prudent to allow these mechanisms to deliver desired improvements in service, at least until there is ample evidence that the desired improvements are not being achieved. Even then, a more targeted approach than that used to subsidize basic services is probably more effective.

B. Preserving Quality of Service in Rural Areas and Targeting Particular User Groups

Contentious, too, may well be new universal service programs designed to benefit not simply particular geographic areas or income classifications, but discrete political groups. The U.S. FCC has made a number of public statements intended to signal that it is taking steps to lower prices and encourage investment in schools, libraries, rural health care providers, and telecommunications services on Native American reservations. [11]

For example, a very recent FCC Order in the Universal Service Docket adopts measures to, inter alia, promote telecommunications subscribership and infrastructure deployment within American Indian and Alaska Native tribal communities. The Order defines "tribal lands" and directs carriers to offer enhanced support for qualifying low-income consumers living on tribal lands [12]. Verizon Communications, the U.S.'s largest local phone company, announced that beginning October 1, 2000 it will offer residents of tribal lands local phone service for as low as $1 a month when they qualify for Native American Lifeline service. To qualify for these programs, residents of tribal lands with limited incomes must meet federal or state Lifeline qualifications or receive assistance from one of a set of designated government assistance programs created to serve Native Americans, or low-income populations in general (e.g., the "Head Start" welfare program).

In Australia, by contrast, the current telecommunications legislation does not specifically target the aboriginal population as a group; there are no telecommunications policies or legislative instruments directed specifically towards aboriginals. Instead, particular aboriginal telecommunications needs are addressed through targeted grants. Australian telecoms policy has also begun several initiatives intended to address quality of services in rural areas generally, without regard to the political affiliation of the rural residents. For example, a growing disquiet in regional, rural and remote Australia about a deteriorating quality of service being provided by Telstra was associated with the Government's policy of selling 50% of Telstra that it owned. The political dilemma for Government was how to redress the decline in service standards while at the same time proceeding with its plans for further privatization of Telstra and USO reform (both were commonly perceived to lead to deterioration in service standards).

As a response the Government has engaged in several rural telecommunications initiatives: 1) the Government reserved about $400 million from the proceeds of the first two Telstra privatization tranches to be directed towards telecommunications projects in rural Australia (ongoing, for up to another 3 years); 2) the Government has set up a wide ranging Inquiry to examine Telstra's performance in rural Australia, undertaking that further privatization of Telstra would not proceed unless it got an acceptable 'report card' (report due 30 September 2000); 3) The Government has announced it will invite tenders for a grant of $150 million to fund the provision of untimed local calls to up to 40,000 people in rural Australia that currently do not have access to this tariff (tender documents likely to be released in September 2000); 4) the Government has invited tenders for a grant of up to $25 million to fund the provision of continuous terrestrial mobile phone coverage on Australia's main highways (tenders must be lodged by 18 Oct. 2000).

Conclusion

Despite wide-ranging changes with respect to telecoms liberalization in Australia and the opening of the local telephone market to competition in the United States, universal service programs continue to be an active feature of regulation. For wireless carriers interested in seeing these programs designed efficiently and operated with no more expense or harm to competition than necessary, it will be particularly important to see that the forces of market competition are brought to bear in a manner that keeps costs down and promotes competition and consumer choice in the market for the basic, subsidized services.

As the market for basic, subsidized services expands to include broadband data and Internet services, the challenges are likely to become still more acute. While no one disputes the importance of ensuring that such services are available widely on an affordable basis, it remains unclear whether government subsidy programs are necessary to breach any "digital divide." For one thing, unlike local telephone service, the provision of vertical services such as advertising and e-commerce suggest that it may be possible for the costs of providing such services in rural areas or to low-income consumers to be borne entirely by the service itself.

Depending on political changes, there may well also be continued pressure to create programs to foster subscribership among particular interest groups who notably fall behind in terms of the availability of affordable service. Prominent among these are groups of native populations who tend to both live in rural areas and have higher incidences of poverty. Addressing this universal service challenge will also require creative policymaking to ensure that the efficiencies of the market are preserved.

References

1. See generally, http://www.aca.gov.au/consumer/uso/index.htm.

2. Ironically, the settlement freed the Bell System in part because it proved too difficult to enforce in light of the economic efficiencies gained by horizontal integration of independents with the Bell System. In 1921, legislation gave the Interstate Commerce Commission permission to exempt AT&T from the antitrust laws for the purpose of acquiring competing companies. Willis-Graham Act, ch. 20, 42 Stat. 27 (1921).

3. Although the term "universal service" was apparently coined by Vail, and a general policy direction was included in the 1934 Act, *see* 47 U.S.C. §151 (1996 and Supp. A. 1999), legislative direction as to what the term meant was not attempted until the 1996 Act. *See* 47 U.S.C. §254 (1996 and Supp. A. 1999). In the interim, the term was given a number of meanings and used for a variety of purposes, not all of them consistent with each other. Vail intended the term to mean that service would be made "universal" by the creation of a single interconnected network. Much later, the separations process created as a result of *Smith v. Illinois Bell* would yield a concept of "universal service" based on intentional cross-subsidies from interstate service to local service. *See Smith v. Illinois Bell*, 282 U.S. at 148 (holding that prices for both local and interstate service must be calculated on a jurisdictionally separate measure of costs).

4. See generally 47 U.S.C. § 254.

5. An eligible carrier can satisfy this requirement even if its "own facilities" are unbundled elements purchased from ILECs. No particular percentage of its "own facilities" is required by the statute. Universal Service Order, para. 163.

6. "Rural telephone companies" are defined at 47 U.S.C. § 153(37). The definition generally covers all LECs smaller than 50,000 lines as well as larger carriers who serve rural exchanges. The statutory definition also allows for certain subsidiaries of large holding companies, e.g., Alltel, TDS, GTE, etc., may qualify as "rural telephone companies." As discussed throughout, LECs who meet this definition are entitled to more favorable treatment regarding the availability of high-cost support and regulatory insulation from competition.

7. Universal service is defined as "an evolving level of telecommunications services that the Commission shall

establish periodically under this section, taking into account advances in telecommunications and information technologies and services." The statute also provides a number of factors which the FCC must consider in determining which services are supported, such as the extent to which such services are "essential to education, public health, or public safety," or have been subscribed to by a substantial majority of residential customers. 47 U.S.C. § 254(c)(1)(A)-(D). The FCC can also designate additional services especially for schools, libraries and health care providers. 47 U.S.C. § 254(c)(3).

8. "Toll rate averaging" means that long-distance carriers may not charge customers in rural areas higher rates than those in urban areas. This is a good example of an implicit subsidy preserved by the 1996 Act.

9. See, e.g., http://www.aca.gov.au/consumer/uso/usoimplement_dp.htm.

Endnotes

[1] See generally 47 U.S.C. § 254.

[2] Ironically, the settlement freed the Bell System in part because it proved too difficult to enforce in light of the economic efficiencies gained by horizontal integration of independents with the Bell System. In 1921, legislation gave the Interstate Commerce Commission permission to exempt AT&T from the antitrust laws for the purpose of acquiring competing companies. Willis-Graham Act, ch. 20, 42 Stat. 27 (1921).

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[4] See generally 47 U.S.C. § 254.

[5] An eligible carrier can satisfy this requirement even if its "own facilities" are unbundled elements purchased from ILECs. No particular percentage of its "own facilities" is required by the statute. Universal Service Order, para. 163.

[6] "Rural telephone companies" are defined at 47 U.S.C. § 153(37). The definition generally covers all LECs smaller than 50,000 lines as well as larger carriers who serve rural exchanges. The statutory definition also allows for certain subsidiaries of large holding companies, e.g., Alltel, TDS, GTE, etc., may qualify as "rural telephone companies." As discussed throughout, LECs who meet this definition are entitled to more favorable treatment regarding the availability of high-cost support and regulatory insulation from competition.

[7] Universal service is defined as "an evolving level of telecommunications services that the Commission shall establish periodically under this section, taking into account advances in telecommunications and information technologies and services." The statute also provides a number of factors which the FCC must consider in determining which services are supported, such as the extent to which such services are "essential to

education, public health, or public safety," or have been subscribed to by a substantial majority of residential customers. 47 U.S.C. § 254(c)(1)(A)-(D). The FCC can also designate additional services especially for schools, libraries and health care providers. 47 U.S.C. § 254(c)(3).

[8] "Toll rate averaging" means that long-distance carriers may not charge customers in rural areas higher rates than those in urban areas. This is a good example of an implicit subsidy preserved by the 1996 Act.

[9] See, e.g., http://www.aca.gov.au/consumer/uso/usoimplement_dp.htm.

[10] See In the Matter of Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Twelfth Order On Reconsideration, No. FCC 99-121, (May 28, 1999). This decision also set the collection rate for the smaller "rural health care provider" subsidy program at $12 million.

[11] See, e.g., http://www.fcc.gov/Speeches/Kennard/Statements/2000/stwek072.html (Chairman Kennard's statement on the success of the "E-rate" program, which targets subsidies to schools. Importantly, "E-rate" subsidies are targeted to schools by income level, not by geographic urban/rural distinctions. This approach seems a more efficient way to targeted subsidies and might be useful guidance for other USO programs).

[12] Twelfth Report and Order, CC Docket No. 96-45, http://www.fcc.gov/Bureaus/Common_Carrier/Orders/2000/fcc00208.txt

Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Calibrated Regulation: Putting to Rest the New Zealand Experiment

Grant Forsyth

Abstract

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History of Telecommunications Liberalisation in New Zealand

New Zealand liberalised its telecommunications market from 1987, with the removal of all regulatory or legal barriers in all markets including: equipment, national and international toll, and local and value added services. The government owned monopoly, Telecom New Zealand, was sold in 1990 to a consortium led by two American telcos, Ameritech and Bell Atlantic.

Since liberalisation, successive governments have taken the view that a market driven, light-handed regulatory framework is an effective means of achieving benefits and efficient economic outcomes [1]. The term 'light-handed regulatory regime' describes the absence of any telecommunications-specific regulation, other than a requirement for the incumbent to disclose some minor information. Primary reliance on achieving effective competition is instead left to general competition law (the Commerce Act 1986), which is administered by the general competition authority, the Commerce Commission.

There have been a number of legal disputes over interconnection, particularly between CLEAR and Telecom. The longest running, initiated in 1991, culminated in a decision of the Privy Council in England in 1996 having traversed 5 years, 3 courts, and 2 countries. Here the eventual court decision was not one that settled the access dispute but rather enabled the incumbent to on-charge any monopoly pricing through the use of the Efficient Component Pricing Rule (ECPR) also known as the Baumol-Willig rule. This resulted in a pricing structure that saw the entrant paying over 2x that which the incumbent paid the entrant for termination and lead to another protracted legal dispute which was not settled until 2000 (out of court).

The only other sector-specific requirements placed upon the incumbent, Telecom NZ, were some universal service type obligations, known as the "Kiwi Share Obligations". They required the continued provision of residential local service at 1989 levels, limiting rises in the price of the local residential line service to the rise in the consumer price index (CPI) and requiring Telecom to continue to offer its residential customers an unmetered local call option, ie. a package that includes the cost of local calls in the bundled fixed line access charge.

Just as nature abhors a vacuum, so no industry remains entirely unregulated. The Commerce Commission concluded in a review of the state of competition in NZ telecommunications as early as 1992 [2] that Telecom NZ was the de facto regulator, and CLEAR agrees with the current Inquiry's conclusion that this remains the case.

The 'light-handed' approach, still known as the "New Zealand Experiment", although it has been in place for over 10 years, has not be followed by any other liberalising telecommunications regime.

State of Telecommunications in New Zealand

Today New Zealand rates as average, at best, in comparison with all other telecommunications markets in the OECD (both liberalised and not). Key comparative indicators include:

- Residential line charges have more than doubled since 1987 and now stand at the highest in the OECD
- Sixth highest rate of increase (out of 24) of OECD residential basket of prices at 13.07% vs OECD average of 2.70% over the period 1996 to 2000
- Second highest rate of increase (out of 24) of OECD business basket of prices at 31.52% vs OECD average of 7.82% over the period 1996 to 2000
- Highest ISDN charges for medium and second highest ISDN charges for small businesses (Australian Productivity Commission) [3]
- Second highest interconnection rate in the OECD
- Growth in the telecommunications market nearly stagnant at 1% for 1999 –compared with 10% in Australia and an international average of 7-9% [4]
- Investment in telecommunications in New Zealand has been below the OECD average for most of this decade
- Second highest fault rate, to Turkey, at 39.5 per 100 residential pair, compared to the likes of France, UK, Germany, Korea at less than 15
- Telecom NZ has been extracting monopoly profits in excess of NZ$382 million per year for local services. [5]

Ministerial Inquiry into Telecommunications

- With a change in Government in 1999, the first comprehensive review of the telecommunications market since liberalisation was launched as the "Ministerial Inquiry into Telecommunications" [6]. While the Final Report of the Inquiry has been passed to Government and is public, the Government's response is not due until after this paper has been submitted.
- The Inquiry took seven months, produced an Issues Paper, Draft and Final Report and provided four occasions for formal submissions including a public hearing. The Inquiry panel undertook extensive international research as documented in the extensive bibliography provided in the Final Report, and made the following key recommendations:
- The appointment of an industry specific regulator, the Electronic Communications Commissioner (ECC), with a staff of 8-10 funded by the industry.
- The ECC's determinations would need to be enforced by a party to a dispute through the courts.

- The establishment to the Electronic Communications Industry Forum (ECIF), with mandated membership for network operators and funded by the industry. The Forum would be guided by the ECC and develop industry codes of practice.

- The creation of a test for determining if services should be "designated" or "specified" (two levels of regulation), called the "access objectives", to promote the long-term interests of existing and potential end users of electronic communications services and a set of requirements for the provision of regulated services known as access obligations.

- The immediate designation of access to Telecom's fixed wire network:

    - at cost-based prices (TSLRIC) – interconnection and data tail (leased lines) access;

    - at retail minus prices (best observed retail minus avoidable costs) – wholesaling; and

    - deferred designation of number administration and portability on a cost based basis.

- The immediate specification of the following services:

    - call origination and termination between all networks (interconnection);

    - carrier pre-selection from all networks (including mobile);

    - wholesaling of mobile services (temporary and for qualifying entrants);

    - roaming between compatible mobile networks (temporary and conditional on network build-out by the qualifying entrants);

    - co-location at mobile cell sites; and

    - Sky's (sole pay per view TV provider) conditional access systems.

    - Other issues were addressed by the Inquiry including: clarification of Telecom's Kiwi Share Obligations (USO), network management, directories, spectrum allocation, information disclosure, consumer information, information society issues, and resource management issues.

The Government's announcement on reforms to the telecommunications market are planned for 20 December 2000 and can be found at http://www.executive.govt.nz/minister/swain/index.html. Given the need for new legislation and the parliamentary process, it is unlikely that reforms will be implemented prior to 2002.

Necessary Improvements: A Holistic Approach

CLEAR believes that regulatory reforms can remove the barriers to competition in telecommunications. There are two key issues: access and enforcement. There are also country specific issues, such as the Kiwi Share. In considering reforms, all should contribute to a holistic approach, each part complimenting the other.

Access to:

- Interconnection with the incumbent's network, at all feasible points, wherever reasonably requested by entrants, on a forward-looking cost basis, and on terms no less favourable than offered by the incumbent to itself.
- Unbundled access to the incumbent's local loop in any practicable form.
- Local call resale on an avoidable cost basis.
- Number portability for all number ranges and types of service that deliver equivalence of service with the costs of upgrading a carrier's network and systems to be borne by that carrier.

Enforced through:

- An industry-specific regulator, that is well-resourced and empowered to enforce the regulatory regime, including industry specific regulation.
- Separation (even if only 'virtual') of the business functions of the incumbent's wholesale and retail operations to support the transparent accounting of costs.
- Full disclosure of the incumbent's costs, and other relevant information at the wholesale level.
- A Universal Service Fund, which is forward-looking and non-discriminatory, to replace the Kiwi Share Obligation and access levy (if contributions are required).

Inadequacies of General Competition Law

There is a clear consensus throughout the developed world that general competition law is simply inadequate to deal with the specific competition concerns raised by telecommunications markets.

"Inherent characteristics of electronic media and communications mean that some market failures are endemic – ie. a competitive market would not address these failures. Such failures are not necessarily the result of firms' abusive behaviour and are therefore not caught by [general competition law]. They arise out of the nature of the industries in question.... rules beyond general competition law are necessary to prevent the residual powers and advantages of incumbents being exploited in a way which frustrates the development of competition or unfairly exploits the consumer." [7]

Regulation is more effective than competition law

It must always be remembered that in liberalised telecommunications markets, you start with an incumbent monopolist with 100% of the market that will naturally seek to maintain its market power. In network industries, competition will not appear organically without serious harm to the wider economy. It is only when a market is effectively competitive that one can consider taking the regulator off the case. However, it is wrong to think about taking the regulator off the case (or avoid having one) before this has happened.

"Some rules beyond general competition law are necessary to prevent the residual advantages of incumbents being exploited in a way which frustrates the development of competition or unfairly exploits the consumer… Competition law, with its emphasis on waiting until an abuse has occurred and focussing remedies on individual abuses, is inappropriate to deal with the long-term and widespread advantages enjoyed by historically incumbent firms." [8]

The courts don't and can't determine terms & prices

Anti-trust provisions of competition law, such as s36 of the Commerce Act, are all about addressing alleged wrongs of a party's conduct – after the fact. In the oft quoted case of Telecom vs CLEAR before the Privy Council, the law lords were only asked to determine whether Telecom's approach to pricing interconnection was anti-competitive – NOT the price that should have been charged.

"Whilst the Court is not unaccustomed to dealing with matters of complex economic theory, pricing methodologies and the like, and whilst it has mechanisms available to assist it in deciding those questions, it was common ground [ie. both parties agreed] that the setting of pricing principles would be a protracted matter of considerable complexity, ill-suited to the adversarial process [of the courts] and one which would require to be regularly, if not continuously repeated". [9]

Experience has demonstrated that litigation is slow, costly, susceptible to manipulation and delay by the incumbent, often fails to produce definite outcomes, and only results in remedies after the conclusion of the proceedings, which can be too late to prevent substantial harm to the developing process of competition.

Regulation increases efficiency in transactions

Contrast the 5 year delay and the expense of litigation with the Inquiry's recommendations of 20 and 30 day response times for determinations and one clearly sees the benefit of a knowledgable empowered regulator over general competition enforcement through the courts.

Although the aim should be to only regulate to the extent necessary to ensure competitive markets, and to roll-back regulation to the point where general competition law can ensure competition to the maximum extent possible, sector-specific regulation will be needed for some time.

Network economy effects

Telecommunications markets also exhibit network economy effects. As has been revealed in the Microsoft anti-trust case, network economy effects produce dramatic 'tipping points' where a player that enjoys market power can easily entrench its position with consequential catastrophic market failure. Additionally, regardless of the determination of abuse, rectification comes so late to such an entrenched position and to markets and services that the passing of time has rendered largely irrelevant, that anti-trust is quite inadequate a constraint on, or modifier of behaviour.

Calibrated Regulation

Regulation has traditionally been viewed as a fairly blunt and homogenous tool that is either 'all on' or 'all off', with particular markets either being regulated or not – with no options in between. Homogenous regulatory solutions are applied to all competition problems whether they arose from market failure, market power, anti-competitive behaviour or the inadequacies of court-based dispute resolution. Regulatory intervention is conceived of as a 'single arrow', with all targets the same in terms of their characteristics, problems, issues and so on.

In New Zealand, this view of regulation was encouraged by the incumbent, since it could then characterise regulation as a monolithic, heavy-handed, 'take it or leave it' solution. The incumbent dwelt on the fact that, under this model of regulation, the negative effects of some aspects of regulation had to be accepted since they were part and parcel of a regulatory approach. It was easy, therefore to characterise regulation per se as causing more problems than it solved.

There is, however, a more sophisticated view of regulation that has been evolving over the last decade or so, which we believe the NZ Inquiry has successfully recommended to a large extent. This approach, which we will refer to as 'calibrated regulation', has a number of components that resolve the relatively simplistic concerns outlined above:

- *Targeted regulation* – asymmetrical regulation targeted where it is needed – at market power;
- *Multi-level regulation* – a recognition that some services (such as interconnection) require greater intervention than others (such as mobile termination);
- *Flexible regulation* – a regulatory system that allows increases and reductions in regulatory intervention and matches appropriate regulatory tools to the specific conditions and evolution of competition in the market in question.

Targeted regulation

It is certainly true that problems do arise when regulation is not carefully targeted at the competition problems it is designed to resolve. Perhaps the clearest example of this are the range of problems that have arisen in the Australian context as a result of the symmetrical approach underlying their access regime.

Unlike the European Union which applies an asymmetrical approach, by determining that certain operators enjoy significant market power in a given market, and therefore should be subject to a more stringent level of regulation (see, for example, the EU Interconnection Principles [10]), the Australian system applies its standard access obligations symmetrically – that is to all operators that provide a given telecommunications service.

This symmetrical approach has caused a number of problems in Australia, including:

The search for informal asymmetry: the Australian regulator (the ACCC) has had to engage in 'creative' strategies to achieve asymmetrical regulation informally, for example, by applying local loop unbundling requirements only to copper networks, which had the practical effect of catching only the incumbent's network and not other carriers' networks (since other carriers used fibre, coaxial cable or wireless technologies for local access);

Arbitration gridlock: where the regulator has been inundated with arbitration requests for disputes between new entrants in which the incumbent (or issues regarding the incumbent's market power) are not involved; and

De facto rate of return regulation: as the ACCC is the designated arbitrator, it often determines pricing principles which become de facto pricing principles for all infrastructure and for all operators, including those without market power, thus placing it in the position of potentially being a de facto rate of return regulator at the wholesale level.

The NZ Inquiry implicitly adopted targeted regulation through its layered approach to regulation, but the rationale for the approach was not clearly articulated – perhaps because the notion of asymmetrical regulation seems somehow 'unfair', or perhaps out of a concern for creating conflict with the competition authority's (Commerce Commission) determination of market power. Incumbents play on 'fairness' in an appeal to some intuitive sense that fairness requires all competitors to be treated equally.

Strict legal equivalence may not, however, produce equality of result. Depending on the market structures and the state of competition, equivalent legal treatment can actually lock in or exacerbate existing inequalities between the regulated entities.

It is important to bear in mind, however, that the targeted approach has a solid foundation in economic and competition theory, and is the only approach that effectively deals with issues arising from market power. Targeted regulation preserves incentives for investment while ensuring that dominant operators are not able to distort competition – the NZ Inquiry's approach risks following the Australian approach into over-reaching the extent of regulation, and may act as a significant disincentive to new investment.

As the Irish regulator has acknowledged, asymmetric regulation is appropriate for asymmetric markets, and many telecommunications markets are still characterised by large disparities in market power:

"In terms of encouraging market entry, I do not mean crutches for new entrants. I want them to get tough quick and stay tough. I want a regime in which they can prosper through their own effort, but nevertheless recognising that they will be facing a very powerful incumbent and that a degree of asymmetry may required whilst the incumbent retains its power... A strong incumbent can, if so inclined, make life difficult, if not impossible, for new entrants. The market is asymmetric and regulation has to be as well." [11]

It is also interesting to note that the ground of the debate has shifted somewhat in recent years, with incumbents not only arguing against targeted regulation but also that the development of competition in various markets or the pro-competitive impact of convergence will soon diminish the need for asymmetrical regulation in favour of general competition law. We concur, however, with the Dutch regulator's assessment of this argument:

"[An objective of regulators can be] moving towards a non-discriminatory policy (a "level playing field"). Regulators in countries with pro-competitive policy argue that a completely uniformed set of rules governing all players equally (and a practical minimum of such rules) is the ultimate long range goal of regulation. In practice, this is generally not a practical option under conditions prevailing today or likely in the near future…." [12]

Multi-level regulation

The second aspect of what we have called 'calibrated regulation' is that regulation is not simply targeted at markets in which operators have significant market power with no further differentiation. Calibrated regulation also recognises that different competition problems in different markets require different solutions.

The traditional regulatory model, whether symmetric or asymmetric tended to operate according to an 'on/off' switch. Under the European system for example, an operator either enjoyed significant market power (in which case it was subject to a range of specific obligations), or it did not enjoy significant market power (in which case it was subject to the same regulation as all other operators). Likewise, under the Australian system, a service was either "declared" under the access regime (in which case all suppliers of that service were subject to a range of specific access obligations), or the service was considered competitive, and few specific obligations beyond general competition law applied.

The approach recommended by the NZ Inquiry, however, implicitly recognises that it is more appropriate to differentiate services and apply differentiated levels of regulation accordingly. Some services may require substantial intervention due to overwhelming market power enjoyed by established operators (for example, the incumbent's market power by virtue of its control of the ubiquitous copper local loop requires that interconnection be subject to a detailed and more intrusive level of regulation). Other services may simply require a framework that encourages multi-lateral accommodations (such as number portability or industry access to directory information). It is therefore inefficient to apply one blanket level of 'regulation' across the board – to either service providers or services.

The model recommended by the NZ Inquiry recognises this approach by differentiating two levels of services – *designated services* that are subject to regulatory intervention including pricing principles (such as leased data tails); and *specified services* that are subjected to a lower level of regulatory intervention (such as collocation of cell-sites).

We see several significant advantages in this 'multi-layered' aspect of 'calibrated' regulation, for example:

- It provides a much better and clearer 'glide path' between general competition law and sector-specific regulation. Regulators are not simply faced with a black and white decision (to regulate or not regulate) since that usually places regulators in a no-win situation – 'to over-regulate or not regulate at all'. Calibrated regulation provides a clear spectrum of regulatory approaches;
- It ameliorates many of the concerns of 'regulatory creep' by providing a clear but graduated 'exit path' from regulatory intervention. Regulation no longer simply disappears once a particular threshold is reached, which allows transitional solutions to be matched to enduring competition concerns in particular markets.

Flexible regulation

The third aspect of calibrated regulation is flexible regulation – a regulatory system that allows a range of flexible options for regulatory intervention. This allows regulators to match appropriate regulatory tools to the specific conditions and evolution of competition in the market in question. While targeted regulation establishes a general structure that directs regulation to the areas where it is most needed, flexible regulation allows regulators to adjust their responses to evolving market conditions and specific problems as they develop.

The traditional view of regulation tended to give regulators very few options for regulatory intervention and enforcement. Until 1997, for example, the Australian regulator had to rely on the courts for enforcement of its decisions. In 1997, however, it was granted the power to issue "competition notices" which were prima facie evidence of breaches of the Australian regulatory regime. This is entirely appropriate for a fast-moving industry such as telecommunications in which irreparable damage can result if anti-competitive behaviour is not deal with quickly.

There appears to be a growing recognition amongst international regulators and governments that a range of enforcement powers is appropriate. For example, the Irish government has proposed a series of reforms to streamline its regulatory regime, including the granting of a wider scope of enforcement options to the regulator. Under the old system, the Irish regulator had only two enforcement options at two ends of the spectrum – the regulator could respond to breaches of the regulatory regime either by applying a fine of 1,500 Irish pounds a day (US$1,700) which proved little deterrent since operators stood to gain exponentially more than this by continuing their anti-competitive conduct; or by commencing litigation and relying on the court system with all its delays, costs and other inefficiencies. The Irish reforms propose a more flexible series of options that allow the regulator greater independent enforcement powers and ensure that:

"... the regulator has an appropriate toolbox of measures to adopt depending on the circumstances in the market, a tool box out of which certain items could be discarded once it was safe to do so." [13]

The NZ Inquiry recommended a model that included many of these aspects of calibrated regulation. For example, there is a multi-layer approach that divides services into three 'tiers' and matches an appropriate level of regulation to the specific problems at that layer:

- *all services* are subject to a 'baseline' of regulation according to general competition law;
- certain *specified services*, such as mobile roaming, and carrier pre-selection, are subject to a higher level of regulatory intervention, with general access obligations applying (such as the obligation to provide access, and non-discrimination); and
- a smaller core group of *designated services* (such as PSTN origination and termination, and wholesaling of retail services) which are subject to the highest level of regulation, including the application of pricing principles to these services.

The approach adopted by the Inquiry is one that we broadly agree with, but there are areas in which the principles of calibrated regulation as outlined above could have been made more explicit, thus giving the proposed regime greater legitimacy, and other areas aspects of the regime that we would like to see fine-tuned, for example:

- the only major difference between the level of regulation applied to specified and designated services is whether pricing principles for those services can be determined be the regulator;
- the test for categorising services into these streams of regulation is unclear since virtually the same test is applied to both categories; and
- it is questionable whether the regulator has been given enough options for enforcement.

We would have liked to have seen New Zealand leap-frog into the front ranks of regulatory best practice, drawing upon the substantial lessons learned over the past decade in Australia, the USA and the European Union. The Inquiry's model goes a long way, but it remains to be seen whether it is far enough.

In summary, we see a range of advantages to the calibrated approach to regulation: it allows for a more dynamic regulatory approach, ensures that regulatory intervention is limited to the minimum necessary, prevents regulatory creep by providing a clear evolution from regulation to competition, strikes an appropriate balance between the need for regulation and the preservation of investment incentives, and ensures that the regulator is able to closely match solutions to the cause of the problem.

But this new approach to regulation has not solved all concerns. Incumbents now characterise this more sophisticated approach as 'dangerous' since it involves 'picking and choosing' various discrete aspects of regulatory systems.

If governments and regulators did little more than pick random elements of international regulatory systems and throw them together as a 'quick-fix' or 'catch-all' solution, we would agree that problems would inevitably arrive. In reality, however, governments and regulators carefully consider the complementarities between various aspects of the regulatory models they are building and ensure that the system as a whole operates in an integrated manner. We are confident that the model recommended by the NZ Inquiry does this effectively.

The future of regulation – convergence, cross-market leverage and the persistence of market power

There is a related interesting debate regarding the future of regulation of communications markets that is proceeding around the world and that arose in the context of the New Zealand Inquiry.

When regulatory systems were first implemented a decade or so ago, it was assumed that regulatory intervention would only be required for a short transitional period, after which time competition would be sufficiently developed to warrant withdrawal from regulation altogether. Regulators and governments have generally, however, not found this to be the case. Rather they have found themselves fine-tuning and reinforcing current regulatory arrangements. Incumbents have fuelled this debate, arguing that this development represents 'regulatory creep', 'regulation for regulation's sake', or is driven by the misplaced desire of regulators to keep themselves in jobs for eternity.

Convergence in communications markets also has substantial implications for this debate since incumbents argue that it is an inherently pro-competitive force that is proceeding at such a rapid pace that sector-specific regulation will shortly be entirely unnecessary.

We encourage this debate, since it obviously has important implications for the future of regulation in telecommunications markets. We believe, however, that the reluctance of regulators and governments to retreat from the marketplace does not reflect self-interest, but is in fact based on more a sophisticated understanding of the nature and dynamics of communications markets, and clear evidence that the market power enjoyed by incumbents will endure for far longer than was first thought.

For example, technological developments are working both to erode the traditional sources of market power, and to bolster them. While it was assumed that the incumbent's control of the copper local loop would quickly diminish in importance as alternative networks were deployed, the slow pace of deployment of alternative networks, and the re-birth of the copper through DSL technology have in fact renewed this source of substantial market power. It is therefore economically appropriate to maintain sector-specific controls on the local loop.

With regard to convergence, we believe that it is critical to carefully examine the nature, pace and consequences of convergence before complex regulatory decisions are taken. There are indeed many forms of convergence proceeding (such as the ability to send traditionally distinct services such as telephony and cable television down a single transmission path, such as DSL over copper), but this does not mean that sector-specific regulation must be immediately dismantled.

For a start, it cannot be assumed that all forms of convergence inevitably mean that markets themselves are converging thus diluting market power. It also cannot be assumed that convergence is proceeding at such a breakneck pace that the immediate dismantling of regulation is warranted.

Different forms of convergence are in fact proceeding at different paces in different markets, and regulatory decisions must not be made without a careful and transparent assessment of whether the pace justifies regulatory retreat. Also it is usually assumed that all forms of convergence are inherently pro-competitive, when in fact, convergence offers many new opportunities for anti-competitive behaviour. For example, while some forms of convergence may indeed bring markets closer together, this increases the scope for cross-market leverage by dominant operators. It is no accident, for example, that in most markets the dominant telephony provider has emerged as the dominant Internet service provider.

In summary, we concur with the Dutch regulator when he states that there is substantial evidence that sector-specific regulation will be necessary for quite some time yet:

"It is often stated that sector-specific rules and regulators…should only be needed for a short period of transition, say, for opening up a national telephone monopoly to competition. This viewpoint is more often based on ideology or vested sector interests, than on analysis of – let alone experience with – the complex issues of network-based competition. It is understandable that the asymmetric burdens of regulation carried out by most incumbent public telecommunication operators during the present transition to a competitive national phone market make these mighty organisations the most vocal lobbyists for early abolishment of sector-specific regulation, and for complete reliance on general competition law." [14]

Conclusion

New Zealand was one of the first countries to liberalise its telecommunications market. At the time there were few tested models to follow and New Zealand's Experiment was considered bold. But after ten years of regulatory wilderness, living an experiment that all others rejected, the result is a regime mired by protracted legal disputes that delivered a mediocre score card and stagnant growth. New Zealand had the opportunity this year to learn from the extensive experience of the rest of the world and to implement reforms that would catapult it into the burgeoning, bandwidth hungry, knowledge economy.

With the exception of not recommending unbundling of the incumbent's local loop, the Ministerial Inquiry into Telecommunications largely fulfilled that opportunity. Its light approach of calibrated regulation, keen eye to the future information society needs, as well as recognition of the enduring power of the local loop, provided for a comprehensive, complimentary set of reforms. It is now up to the Government to put New Zealand up with the leading telecommunications markets of the world.

By January 2001 when this paper is presented at PTC 2001, the question of whether New Zealand's Experiment has been put to rest will be known.

Endnotes

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[12] Muller, *International Experiences in Competition and Regulation in Telecommunications Industries*, 1996

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[14] Professor Jens Arnbak, Chairman, Independent Post and Telecommunication Authority (The Netherlands); *The Fourth Information Revolution: Policies for Open Access*, keynote speech delivered to the International Telecommunications Union Regulatory Summit, Telecom '99, Geneva (11 October 1999)

Back to top of page **Back to the sessions page**

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Grant took up the role of Manager Industry and Regulatory Affairs at CLEAR Communications in December 1998. In this role Grant is responsible for managing the development and articulation of CLEAR's public policy position on matters to do with its relationship with the industry and government officials. This is achieved within a team in the Corporate Affairs Directorate.

During 2000 Grant led CLEAR's effort to achieve regulatory reform in New Zealand through major contributions to the NZ Ministerial Inquiry into Telecommunications.

Prior to joining CLEAR, Grant held the position for five years as Chief Executive of TUANZ (The Telecommunications Users Association of New Zealand Inc). In that role Grant has presented papers at international and national conferences on topics ranging from Universal Service to the Ethical Dilemmas Arising from Privatisation of Telecommunications. Given the "light-handed" regulatory regime operating in New Zealand, much of the public policy focus of TUANZ has been directed at seeking improvements and greater user benefits through competition.

Grant has spent 13 years in the computer software industry. Initially working as a systems analyst for large corporations in the USA and England. Grant made the move to PCs, packaged software and general management upon returning to New Zealand where he worked for PAXUS. He left PAXUS to run, along with three others, his own software development and distribution company specialising in open systems.

Grant has a BE from the University of Auckland, an MSCE from the University of Washington in Seattle and completed an Executive MBA at the University of Auckland in 1995.

Back to proceeding page **Back to the sessions page**

$ **Economics & Financing**

Monday, 15 January 2001
1400–1530

M.2.6 IP/Next Generation Networks

Chair: AILEEN PISCIOTTA, Kelley Drye & Warren LLP, *USA*

M.2.6.1 Enabling Consumers: Impact on the Future Interconnection of Networks (ABSTRACT)

BERNADETTE JEW, Partner; ANGUS HENDERSON, Partner; and ROB NICHOLLS, Partner, Gilbert & Tobin, *Australia*

M.2.6.2 Next Generation Networks and Services (ABSTRACT)

PETER FALSHAW, Director of Consultancy-Asia Pacific, Ovum Pty Ltd, *Australia*

M.2.6.3 Localizing the Global Internet: Improving Cost of Access and Quality of Service for Asia

RANDY ZADRA, President & Chief Operating Officer, Orblynx, *USA*

Enabling Consumers Future Impact on the Interconnection of Networks

Bernadette Jew, Angus Henderson, and Rob Nicholls

Abstract

www.gtlaw.com.au

1. INTRODUCTION

1.1

Imagine a converged communications environment where consumers can walk into their local shopping centre armed with an intelligent end user device and use the communications services offered to consumers within that particular shopping centre:

- short messaging services advertising pricing specials and entertainment events available in the shopping centre; promotional competitions;
- low-cost telephony, email and messaging services to assist shoppers in arranging a rendez-vous with friends;
- Web access to retail information provided by various retailers within the shopping centre; and
- access to their bank accounts for the purpose of checking bank balances and transferring funds between accounts.

1.2

Imagine being able to use these types of services at any shopping mall simply by registering online - without the need to specifically subscribe to a number of different networks and the specific proprietary services offered by each of those networks.

1.3

What if consumers need to become customers of the particular network provider that the mall owner is associated with before they can access the services within that particular shopping mall? What if consumers are unable to access these types of services at another shopping mall unless they join a rival network provider and purchase a new end user device compatible with the competing network?

1.4

The emerging intelligent networks have the technical capability to support the delivery of such services to each and every consumer walking into a local shopping centre -regardless of their chosen hand-held device and regardless of the network to which the consumer is connected.

1.5

The only impediments to the ability of consumers to access such services are commercial, rather than technical, limitations that tend to occur at the level of network interconnection. Interconnection between networks has traditionally been governed by competitive imperatives, with the objective of winning customers on the basis of "I've got this service and others don't". This approach has manifest itself in traditional customer lock-in strategies, which encourage rudimentary interconnection arrangements and closed proprietary standards.

1.6

However, with the devolving of intelligence out to the edge of the communications networks, consumers will emerge as the strongest opponents of such interconnection arrangements based on customer lock-in. Such an approach limits, rather than maximises, the potential interoperability of the interconnecting networks and the devices connected to them. More importantly, it will deprive end users of the ability to fully exploit the burgeoning opportunities inherent in their intelligent end user devices.

2. THE NEW INTELLIGENCE EMBEDDED IN END USER DEVICES

2.1

The convergence of telecommunications and computing technologies is creating the potential for an entirely new range of services for consumers. With the emergence of intelligent network functions and user interfaces, it is possible to provide customers with access to network databases - resulting in greater control and flexibility for the customer, with minimal administration on the part of the operator. In effect, the 'intelligence' is moving 'out to the edges' of the various networks and into the hands of consumers.

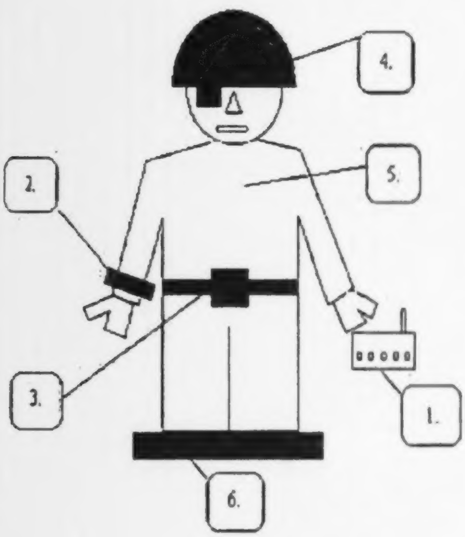
2.2

Furthermore, the range of end users devices available to consumers becomes unlimited as the computer is taken out of its box and embedded in:

- fixed appliances - encompassing smart houses, smart cupboards, smart refrigerators, smart medicine cabinets, and evolving into home area networks;
- smart structures, smart highways and smart places; and
- hand-held devices and other personal items connected to mobile platforms - transferring mobile services into "wearable computers".

The computer enabled end user:

(see further Attachment A)



1. ***Portable device:*** Wireless internet enabled portable computer, phone, camera and scanner (widely available in near future)
2. ***Wrist device:*** Wrist computer and digital display may replace portable computer (prototypes in limited commercial use)
3. ***Wearable computer:*** Attached mobile computer (prototypes in limited commercial use)
4. ***Head mounted devices:*** Head mounted visual display unit, earphone and microphone (opaque liquid crystal eye glass or contact lens to replace early bulky prototypes)
5. ***Devices embedded in clothes:*** Computer clothes, the human body as a conductor, implantable microchips, the human skin as a visual and hearing device (early research and development phase)
6. ***Toe operated sensors:*** Shoe as computer, power source and casino aid (already banned in casinos, other aspects in research and development phase.

2.3

This exponential growth in the range of end user devices has been propelled by advances in telecommunications, with the development of intelligent programmable networks incorporating distributed logic and databases, high-speed common channel signalling and open application program interfaces. These developments enable:

- an increasing number of devices to talk to each other using a common language such as the Internet Protocol technologies, eg: cell phones talking to Webservers talking to palm pilots talking to toasters;
- a single network to handle communications in all its myriad forms - voice, data, email, fax, file transfer and video; and
- a consumer to 'carry' the service that he or she has selected across the integrated networks of the carriers.

2.4

As a consequence, we are witnessing a rapid shift to machine-to-machine communications:

today we have 6 billion people and 14 billion processors;

it is estimated that by 2010, there will be 10,000 telemetric devices for every human being on the planet (Ernst & Young); with 95% of all traffic over communications networks comprising machines talking to each other, and only 5% of the traffic comprising voice, ie: people talking to each other (BT Labs).[1]

2.5

These developments are allowing the traditional voice telecommunication industry to converge with other businesses, including media and commerce. This convergence paves the way for consumer services focused on access to the data stored in databases, rather than any particular telecommunications links:

- A call is directed by a database to an electronic address, rather than to a particular phone line, with 'geographically based numbers' being increasingly replaced by personal numbers and IP addresses. This means that when users log onto a corporate intranet and identify themselves to the network, they will be granted access and other rights that allow them to obtain email and other messages at the relevant user location (which is an IP address).
- The common signalling platform and database enables networks to track subscribers. We have become so accustomed to conventional telephony that it takes a moment before one realises that a traditional telephone connection represents a place, not a person. This requires functionality which is broadly analogous to that employed for roaming between international mobile networks.
- This enables the development of so-called 'personal assistants' which can connect with a single consumer via the network which the consumer chooses from time to time (this will vary throughout the day, depending on whether the consumer is in transit and needs to use a mobile network, or whether the consumer is connected to a particular fixed network at work or at home). Personal assistant services:

  i. enable consumers to access all messages, receive and make calls or retrieve personalised content, so that the personal assistant becomes the customer's first point of call when accessing a network; and
  ii. enable the integration of enhanced telecommunications services such as voicemail, callback, conference calling, personal numbering and intelligent call waiting with new enhanced services such as content, schedules and advertising.

2.6

Applications and services also become much smarter in this new converged environment:

- when voice is converted into a series of IP packets, then advanced voice services can be employed via the familiar Web browser. In other words, voice traffic can be handled in the same way as email. A form of Web browser can then be used as an interface to access corporate directories, to set up personal address books, to initiate conference calls and so on;
- Wireless Application Protocol (WAP) devices can recognise the resources of the user's device: if it is a smart phone, no file attachments will be sent; if it is a notebook, they will - if the user has configured his or her services in that way; and
- mobile e-commerce becomes more and more feasible: GSM phones already use smart card technology to protect users and digitally encode speech to prevent eavesdropping. Some handsets are now equipped with fingerprint recognition pads so that financial transactions can be properly authenticated.

2.7

However, while much of this intelligence is now part of the standard equipment and software releases from suppliers, it will be of little practical value unless consumers are able to fully exploit the potential benefits of this new intelligence - and this will require an unprecedented level of technical interworking between networks including:

- seamless interworking between mobile and mobile networks, mobile and fixed networks and fixed and mobile networks;
- the capability to roam across fixed and mobile networks regardless of the customer access device used;
- real time database access between networks;
- administrative co-operation and flexibility between networks; and
- sophisticated intercarrier billing arrangements.

2.8

Although this level of interworking has the potential to deliver very real benefits to consumers, it is by no means assured that network providers will in fact deliver such benefits. Indeed, as we shall see, network operators (particularly those with the most ubiquitous networks) have strenuously resisted this level of interworking.

3. THE DEVELOPMENT OF INTELLIGENT NETWORKS

3.1

It is important to understand some of the key advances in the development of networks over recent years, particularly in signalling and switching systems, in order to understand the extraordinary potential of the emerging end-user devices.

Developments in signalling

3.2

The history of the functionality of networks shows a clear progression from legacy networks (in which service logic which was hard-wired into the switching system itself) to intelligent network (IN) solutions which distribute a high level of intelligence throughout the network - by taking the intelligence out of the switch and placing it in computer nodes that are distributed throughout the network.

3.3

Traditional telecommunications networks have relied on built-in switching mechanisms to route calls to a destination. This meant that even small service changes and system upgrades required the deployment of new hardware at a number of central points throughout the network, such as trunk exchanges.

3.4

In the mid-1970's, the first intelligent switching system was introduced - common channel signalling system 7 (SS7) - providing the foundation for intelligent networks.[2] SS7 removes the need for signalling via the voice band ("in-band signalling"). Instead, it enables information relating to the call[3] to be separated and carried on a different path to the voice and data traffic that it supports.[4] This results in faster call set-up times and frees up the trunk circuits between switching systems for the actual calls, resulting in more efficient use of voice circuits.

Advanced Intelligent Networks

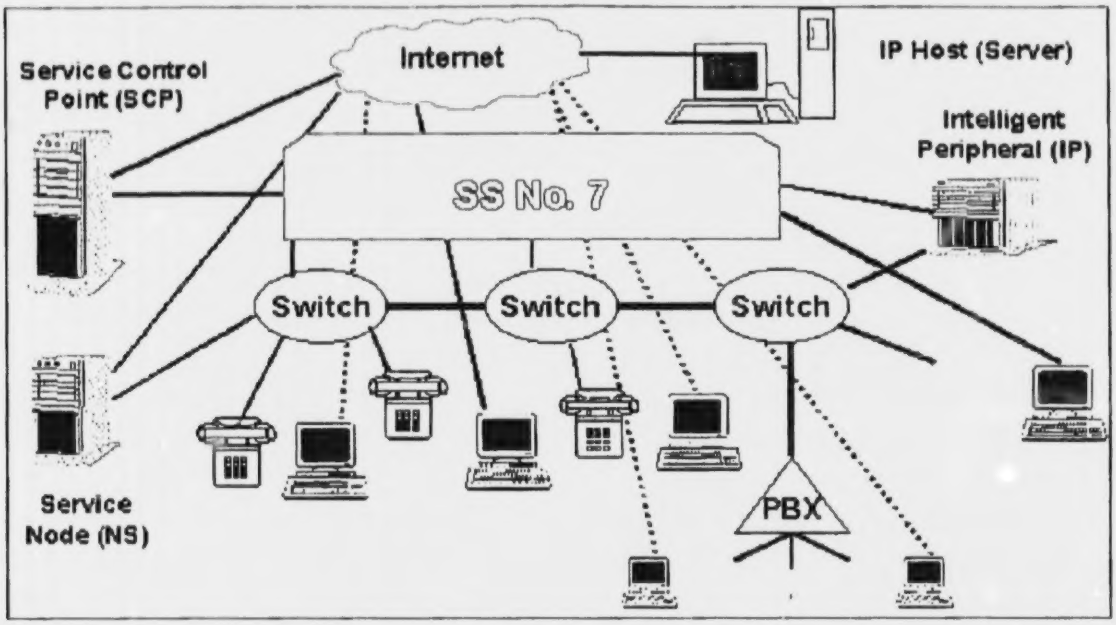
3.5

These signalling developments have subsequently given rise to the establishment of advanced intelligent networks, comprised of intelligent nodes or databases which are external to the switching systems. Individual databases are linked via SS7 to support a variety of services and advanced call handling features across multiple vendor domains:

- the network has the capacity to utilise real-time database interactions to control the routing of telephone calls;
- this enables calls to be routed to their eventual destination by the shortest distance, utilising computer power to make more efficient use of network bandwidth; and
- a database can serve several switches, freeing switching capacity for other functions.

3.6

In effect, the SS7 network acts as the backbone for the advanced intelligent network, interconnecting thousands of service providers under a common signalling network:


Service Control Point (SCP)
Internet
IP Host (Server)
Intelligent Peripheral (IP)
SS No. 7
Switch
Switch
Switch
Service Node (NS)
PBX

3.7

More specifically, the service switching point (SSP) initiates and terminates SS7 messages to:

- switch the origination, termination or tandem calls;
- receive signals from the CPE; and
- perform call processing on behalf of the user by interacting with the service logic located in the called service control point databases (SCPs).

As SCPs have become executors of services (rather than just the databases they used to be), the function of the databases has been moved to devices called service data points (SDPs).

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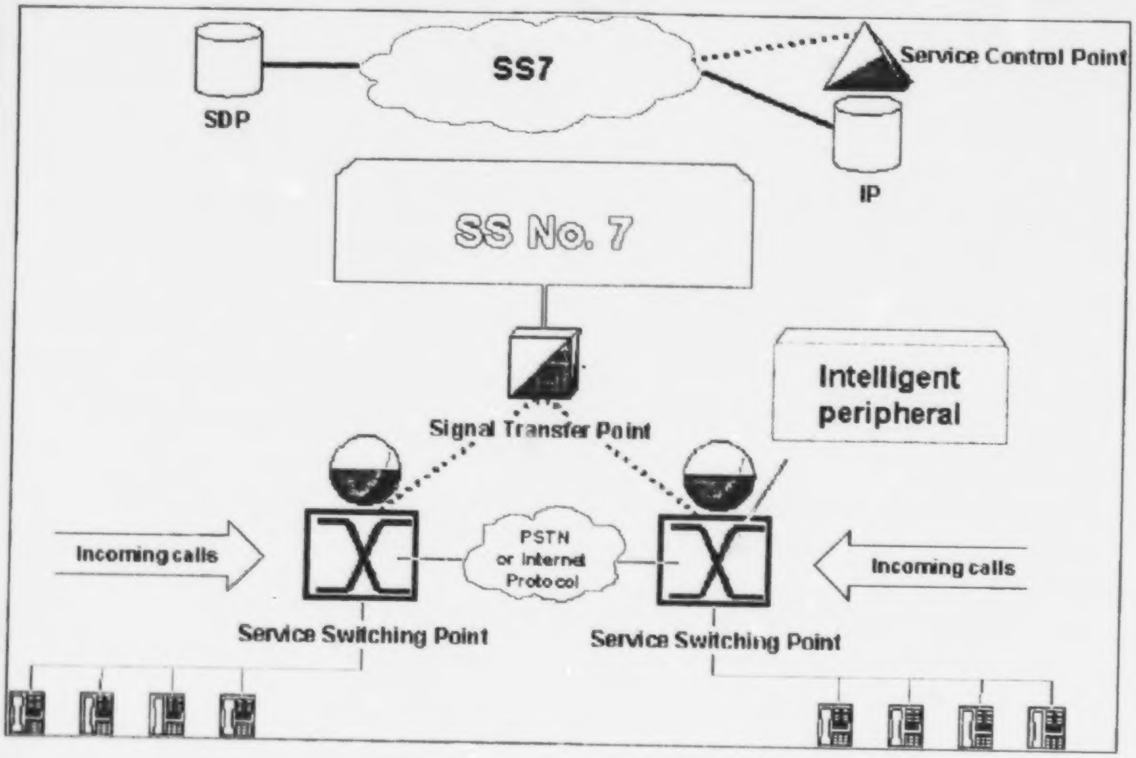

3.8

The evolution of intelligent networks has enabled significant changes to be introduced into telecommunications networks through virtually instantaneous deployment of new software and, more recently, through the re-calibration of end user devices by consumers themselves:

- An intelligent peripheral connected to the telephone network via a line or trunk enables it to communicate with a human via a voice circuit - with the SS7 network receiving instructions from the SCP via the intelligent peripheral.
- The intelligent peripheral supports flexible information interactions between an end user and the network, and enables the signalling network to access data bases of customer instructions / information in order to take "intelligent" actions.
- By giving a customer access to a database which determines where calls are sent, an intelligent network can pass on greater control and flexibility to the customer with minimal administration required by the operator.

3.9

Generic platform functionalities have been developed by SCP vendors, with the specific service logic being overlayed in the application functionality. The software bottleneck caused by switching vendors is being eliminated, due to the fact that service providers are now able to acquire SCP applications functionality from sources other than the traditional switch manufacturers:

- Those alternative suppliers are developing software with non-proprietary applications programming interfaces which are capable of linking the SCP applications to a range of switching systems.
- By comparison, switching vendors were previously the sole source of SCP functionality, and they inevitably took the opportunity to incorporate proprietary interfaces into that applications functionality to link it to their particular switching systems.
- Recent developments are reducing the dependency of service providers on switching system vendors for software development and delivery schedules. They enable the service provider to create and control services in a cost-effective manner, enabling the rapid introduction of new capabilities into the network and customisation to meet individual customers' needs.

3.10

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The types of telephony services supported by an intelligent network include:

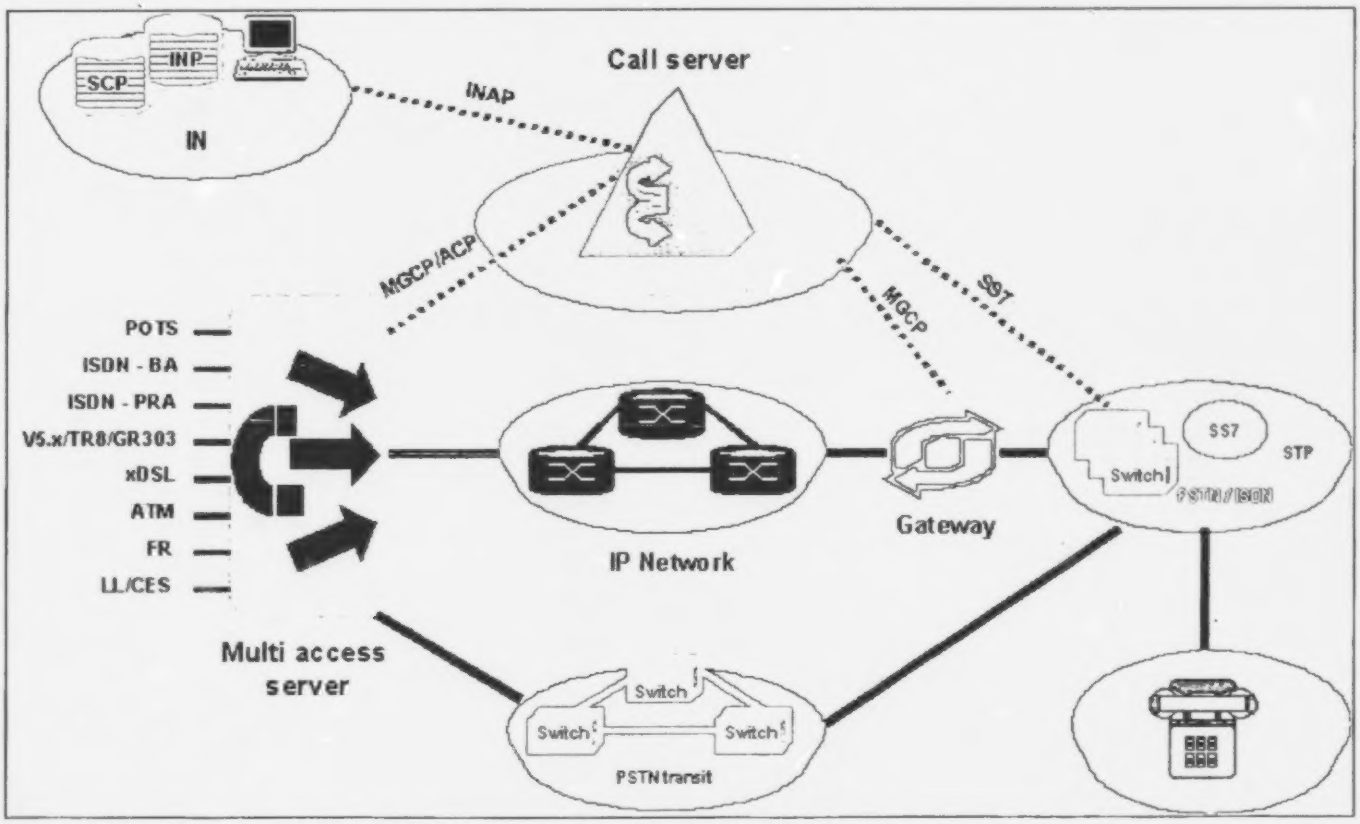
- Single number service (allows calls to have different call treatments based on the originating geographic area and the calling party identification);

- Selective routing (determines where to route a forwarded call, based on the caller's number);
- Personal access (a type of "follow me" service - a virtual telephone number is assigned to the personal access service subscriber and, when a call dials this number, the software determines how to route the call);
- Work-at-home billing (allows a person working at home to dial a feature access code, which prompts the system to track and record the billing information for the calls - and calls tracked in this manner are billed directly to the company, rather than to the individual);
- Inmate service (routes prisoners' calls, tracks the call information, and offers call control features such as prompts for personal identification numbers, blocking certain called numbers and time or day restrictions);
- Call counter (increases a counter in the televoting (TV) counting application when a call is made to a TV number - the counts are managed in the SCP, which can accumulate and send the results during a specific time period);
- Advertising effectiveness service (collects information on incoming calls which can be used by advertisers to determine the demographics of their customers);
- Inbound call restriction (allows a customer to restrict certain calls from coming into the subscriber's location - whether restricted by area code or particular telephone numbers; restrictions may even be specified by day of week or time of day);
- Outbound call restriction (allows a customer to restrict certain calls from being completed from the subscriber's location - whether restricted by area code or particular telephone numbers; restrictions may even be specified by day of week or time of day); and
- Signalling systems in mobile networks use a complex series of messages to enable roaming between national and international networks. The signalling system interrogates the subscriber's home databases to determine what roaming rights are enabled, then creates temporary records in a visitor database which are used to complete subsequent calls.

Convergence

3.11

As the demand for higher speed data networks began to overburden the voice infrastructure, this lead to the development of separate overlay data networks. Accordingly, at the same time as the PSTN was evolving into an intelligent network, data networks were evolving in tandem. Unlike the circuit-switched architecture of the PSTN, data networks deploy packet technology. However, although PSTN and data networks are fundamentally different in terms of routing and performance, it is possible for the networks to be connected, exchanging voice and data traffic. The computers on the network are all interconnected, with the bandwidth being shared by all active users.



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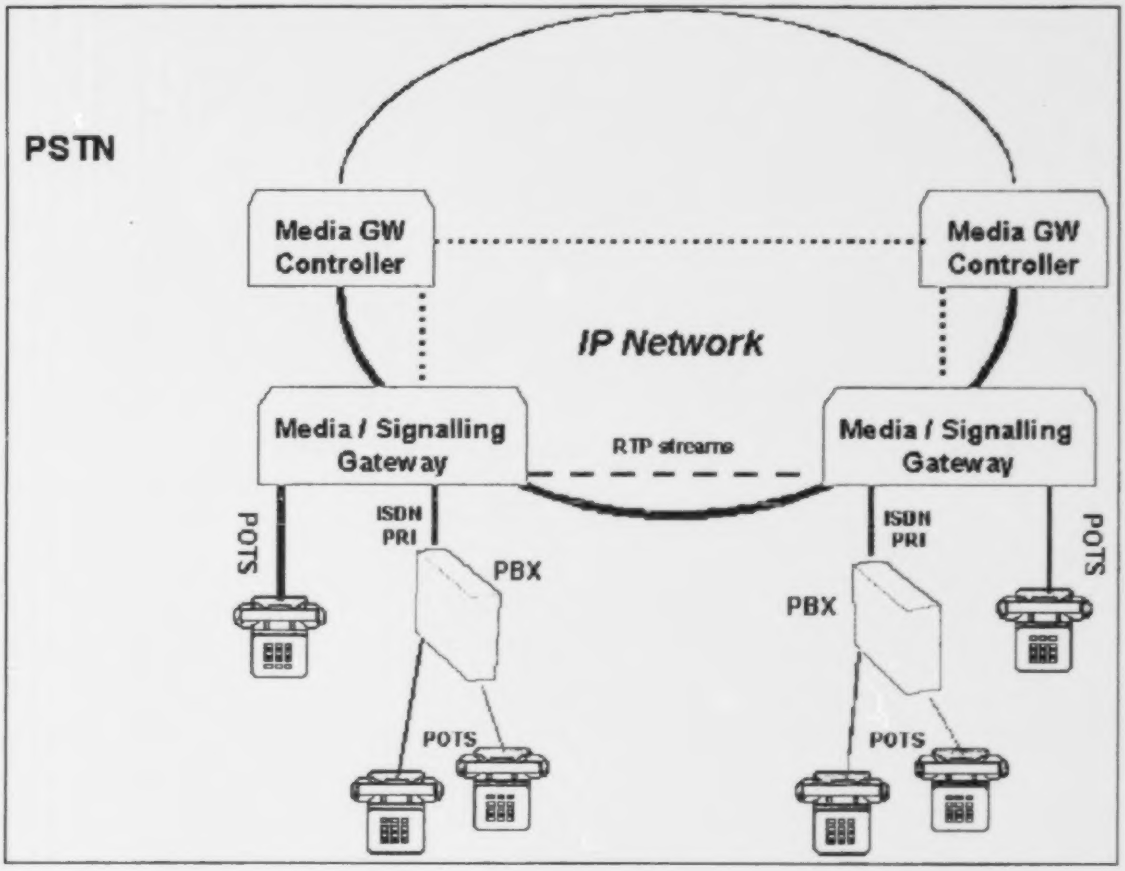
3.12

Furthermore, the advanced intelligent network architecture is now capable of supporting both traditional PSTN circuit-switched technology and data-packet technology:

- Calls can be initiated and terminated on the PSTN or, alternatively, via Internet protocol (VoIP) technology over the IP network.
- Next generation media gateways support a variety of traffic - data, voice, fax, multimedia and others, over a data backbone.
- The convergence of these two different network architectures creates capabilities that neither network can support on its own.


PSTN
Media GW Controller
Media GW Controller
IP Network
Media / Signalling Gateway
RTP streams
Media / Signalling Gateway
POTS
ISDN PRI
PBX
ISDN PRI
POTS
PBX
POTS
POTS

3.13

We have therefore come full circle in the convergence evolution - now the goal is to carry voice over a network originally deployed for data using packet technology based on asynchronous transfer mode (ATM) or Internet protocol (IP).

3.14

In practical terms:

- a local call is placed to the IP-telephony switch (which is a multimedia computer equipped with telephony software), with voice traffic being digitised and compressed into data packets and then sent across the IP network;
- media gateways are distributed around the network while the SS7/IP gateway is centralised - connected to the SS7 network in a convenient location near an existing STP, and communicating with the media gateways and other modules using the IP network.

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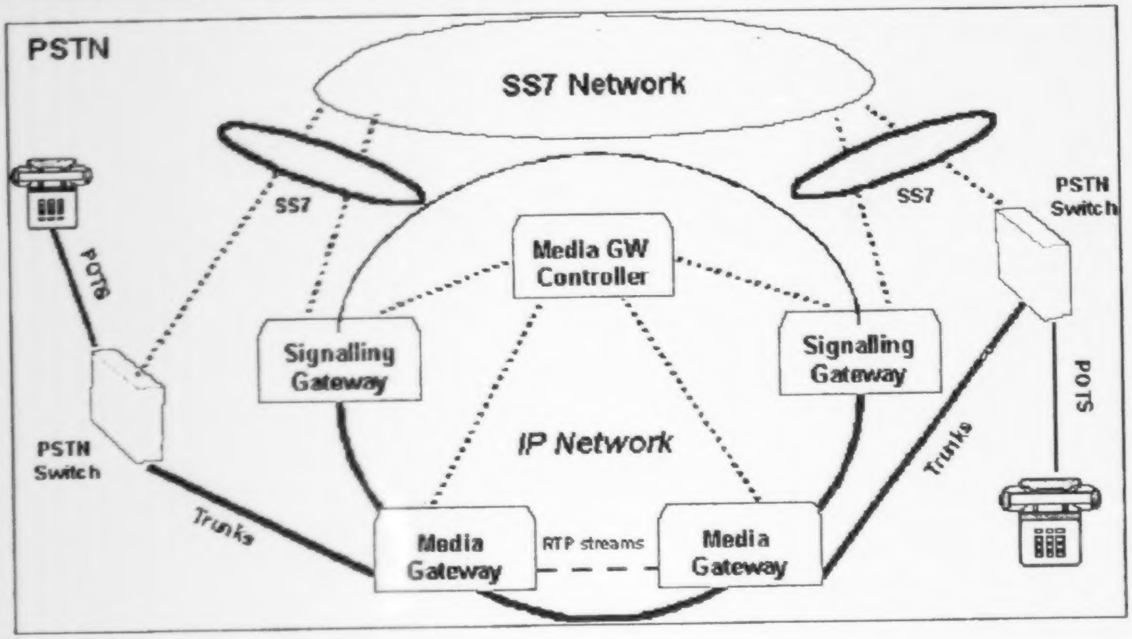
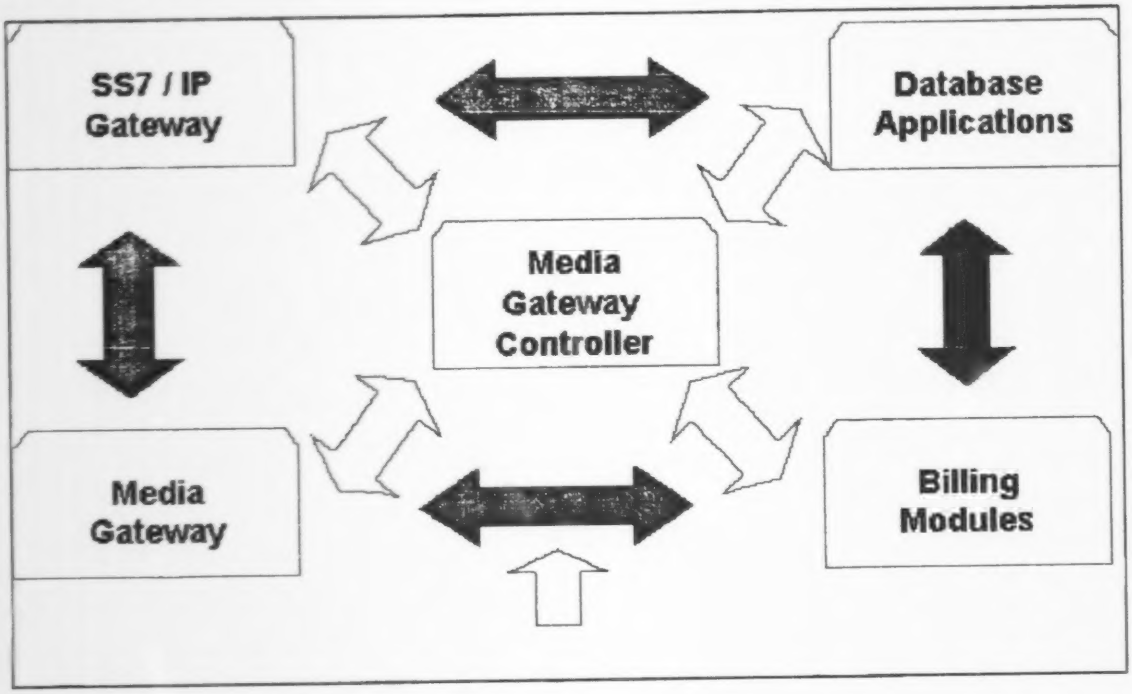

PSTN
SS7 Network
SS7
SS7
PSTN Switch
POTS
Media GW Controller
Signalling Gateway
Signalling Gateway
IP Network
PSTN Switch
Trunks
Trunks
POTS
Media Gateway
RTP streams
Media Gateway

3.15

IDespite the distributed nature of this configuration, the entire collection of modules appears as a single switch to the SS7 network. It has a single point code, which is used to manage all of the media gateways. Rather than requiring that each and every IP-telephony switch provide SS7 support, this architecture provides well-defined signalling interface points between the two networks:


SS7 / IP Gateway
Database Applications
Media Gateway Controller
Media Gateway
Billing Modules

4. ENABLING CONSUMERS TO EXPLOIT THE INTELLIGENCE AT THE EDGE

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4.1

The rate of progress of convergence of the telecommunications and computer industries, and the ability of consumers to fully exploit the intelligence incorporated in intelligent networks and end user devices, will ultimately depend on developments in interconnection and protocol standardisation.

Current limitations on the scope of interconnection

4.2

The traditional approach to interconnection, driven by competitive imperatives, has manifest itself in customer lock-in:

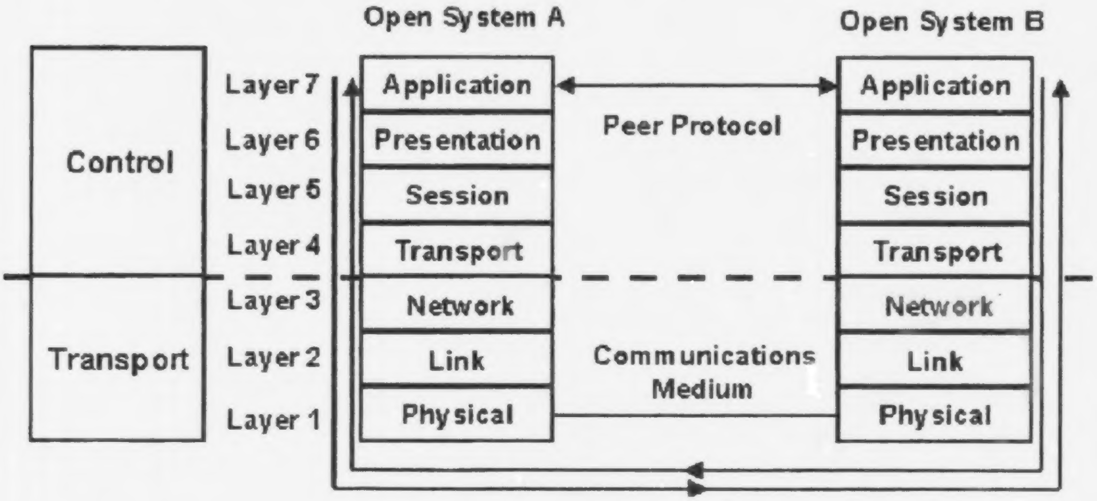
interconnection has been viewed in 'two-dimensional' terms as a finite number of largely autonomous, independent networks 'touching' at a limited number of Points of Interconnection (POIs);the intelligent network capabilities and functions of a network have tended to be specific to that network, and limited to that network in their scope of operation. That is, intelligent network functionality between interconnected networks has been limited by the commercial decisions of the service providers involved, rather than by the technology or standards;[5] and

while the intelligent network environment provides the capability for networks to exchange information via direct access to each other's databases on a real-time basis, the telecommunications industry is marked by an absence of real-time access and the flexibility required to support the new intelligent end user devices.

4.3

The effect is to limit, rather than maximise, the potential interoperability of the interconnecting networks and the devices connected to them:

- A rudimentary approach to interconnection has ensured that the scope of information exchanged between networks is generally limited to transport layers 1 and 2, with negligible exchange of information at transport layer 3 and at the applications or control layers.
- The transportation of information can certainly be completed in the lower three layers of the Open Systems Interconnection model. Indeed, conventional voice telecommunications is conducted using only the physical and the link layers. Circuit switched telephony merely provides circuits for calls so that circuit switches are layer-two (link) devices.
- However, the increased complexity associated with intelligence in edge devices means that layers three and four are required for routing and control:
    - Internet Protocol (IP) is a layer-three (network) resident, and devices such as IP routers and switches (but not bridges) are layer-three devices; and
    - the transport layer (layer four) is tightly linked to the functionality of intelligent edge devices and may be implemented as either Transport Control Protocol (TCP) or User Datagram Protocol (UDP), depending on the type of data to be communicated.



Interconnection developments required to enable consumers

4.4

Consumers enabled with intelligent end user devices will no longer be content with interconnection which is limited to layers 1 and 2 at the transport level - this offers little more than an end-to-end circuit. Consumers are effectively seeking access to (distributed) computing power:

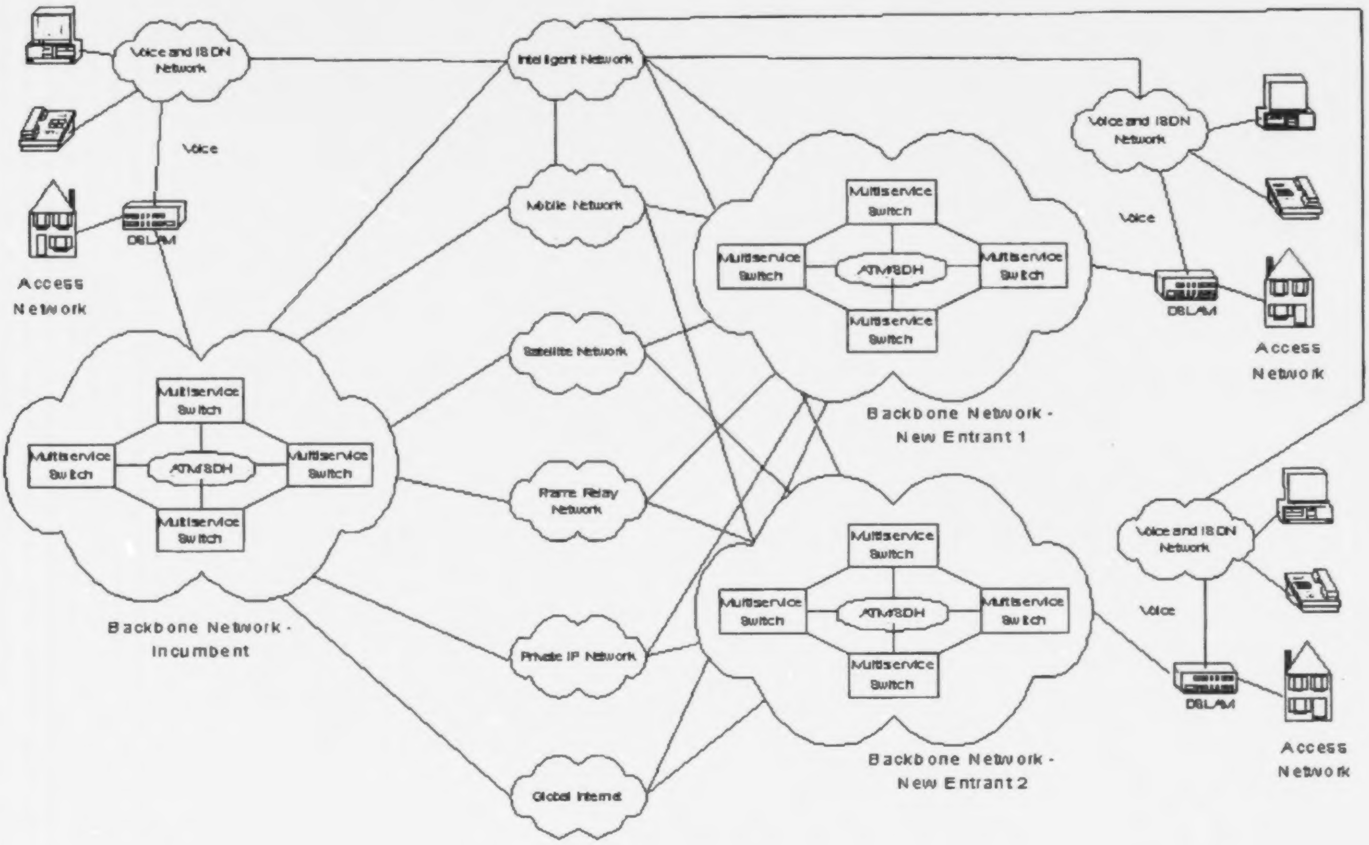
- at its simplest, they are seeking access to the data and functionality previously located on their PC or on a LAN service; and
- at a more sophisticated level, they are seeking access to a package of computing, connectivity, software and storage services[6].

4.5

The level of interconnection required to support this level of consumer access can only be achieved through the development of an integrated platform of hardware and software across the interconnected networks of the carriers. Furthermore, the ubiquity required for this "interconnected economy" demands openness and standardisation between networks.

4.6

The goal of the telecommunications industry must therefore be one of creating a world-wide seamless grid of networks. This requires interconnection between multiple networks - encompassing robust, reliable and highly flexible solutions that can support all of the complex real-time processes and business processes generated by the proliferation of end user devices.


Voice and ISDN Network
Voice
DSLAM
Access Network
Intelligent Network
Mobile Network
Satellite Network
Frame Relay Network
Private IP Network
Global Internet
Multiservice Switch
ATM/SDH
Backbone Network - Incumbent
Backbone Network - New Entrant 1
Backbone Network - New Entrant 2
Voice and ISDN Network
Voice
DSLAM
Access Network
Voice and ISDN Network
Voice
DSLAM
Access Network

4.7

There will be numerous new interfaces in this converged grid of networks, be they:

- Operation and Support System (OSS) interfaces between the databases of the various networks;
- transport protocols;
- signalling protocols; or
- new interfaces that do not currently exist, or have not yet even been contemplated.

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Improving customer service through open access to network databases

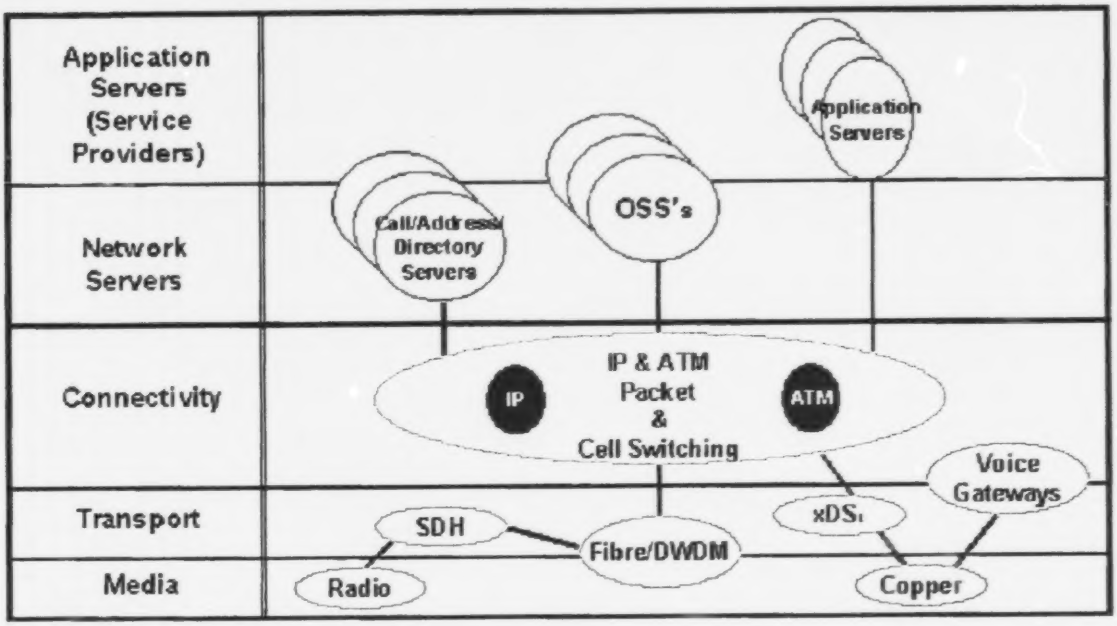
4.8

Turning first to the OSS interfaces between the databases of the various networks, open access to network databases is frequently referred to as "electronic bonding". Standardised interfaces enable telecommunications networks to interconnect operational systems both internally and externally - interconnecting with the systems of suppliers and customers

4.9

The OSS interfaces are an essential element of the seamless grid of networks. In order to realise the full potential of the benefits offered by advanced intelligent networks, there must be open access to customer information stored in network databases, so that:

- the customer can access data which he or she has stored in a particular database from whichever network which he or she chooses to log into throughout the day; and
- in circumstances where a customer chooses one particular service provider to manage all of his or her telecommunications services, that service provider can obtain all relevant information about the customer's services acquired from other networks - and this requires the service provider to be able to access the customer databases of the relevant network (relating to pre-ordering, ordering, provisioning, billing and fault management) in the same manner as the owner of the network.



4.10

Electronic bonding not only enhances the openness and connectivity of networks - it has also become a primary competitive differentiator in telecommunications, improving business processes and making them less costly to operate. An absence of electronic bonding raises costs, impacts detrimentally on customer service and impedes the ability of any one service provider - except perhaps an incumbent operating a ubiquitous network - to provide a one-stop shop for its customers.

4.11

It is for this very reason that incumbents have been the strongest opponents of electronic bonding. Electronic bonding results in consumers becoming less dependant on the ubiquitous services of the incumbent - since it enables consumers to acquire all of their services from a particular service provider on a competitive basis, even if some of their services are delivered over the incumbent's network:

- For example, in situations where a component of the consumer's services comprises services delivered over the incumbent's network (such as the resale of local calls, or services offered over the unbundled local loop), the quality of service that new entrants are able to deliver to their customers depends greatly on the interfaces to the incumbent carrier's databases.
- New entrants cannot afford to be mere order-takers, they must provide added value in the form of customer service, customer care and customer billing. They also need to be able to provide real-time support for multiple services.

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- All of this requires simple and instant access to the customer databases of the incumbent (relating to pre-ordering, ordering, provisioning, billing and fault management) in the same manner as the incumbent in order to be able to deliver the full range of services to customers on a competitive basis.

4.12

However, while recent regulatory developments have generally enabled new entrants to resell local calls and provide xDSL services over the incumbent's unbundled local loop network, incumbents will generally avoid providing real-time access to the associated customer databases unless they are forced to do so by virtue of regulation or the threat of regulation. Incumbents will generally seek to limit the scope of interconnection to more basic electronic interfacing, without offering solutions based on the real-time interworking of databases.

4.13

This is a clear demonstration of the tendency for incumbents to limit the scope and flexibility of interconnection. In these circumstances, the ubiquity of the incumbent impedes development across the industry and limits the competitiveness of the services that are available to consumers. The lack of industry progress in this area raises scepticism that a 'committee of competitors' can move fast enough via self-regulation, or for that matter agree on where it should be moving.

4.14

In the United States this issue was dealt with by the FCC through regulatory requirements for OSS interconnection. A critical portion of the Telecommunications Act 1996 and its associated orders deal with OSS interconnection. Regulations require the regional Bell operating companies (RBOCs) to provide competitors with access to their customer databases and various OSS functions such as preordering, ordering, provisioning and fault management.

4.15

As a result, new generations of OSSs are now being developed in the US to address enterprise data information management. Furthermore, we have subsequently seen the development of flexible gateway products intended to help new entrants develop the interfaces necessary for interconnection with RBOC OSSs.

4.16

By comparison, we have seen little progress in those jurisdictions where the regulators have adopted a hands-off approach to electronic bonding. For example, there does not currently appear to be any willingness on the part of the Australian incumbent to incorporate this level of interworking into interconnection arrangements. This is despite the fact that electronic bonding actually has the potential to produce a win/win solution for both access providers and access seekers. It eliminates manual processes and resource-intensive data matching efforts, and has a significant and positive impact on the quality of services provided to customers.

The need for standard protocols

4.17

The openness and standardisation between networks requires agreement on the standard protocols to be used on the IP network. These protocols must cover all aspects of communications, including voice compression, multimedia transmission, and signalling. The adoption of standards will enable equipment from multiple vendors to coexist and interoperate on the network.

4.18

Currently, there is a marked absence of global standardisation for IP protocols. Several different standards are currently under development by various standards bodies and industry consortiums around the world.[7] While the ITU has developed detailed and comprehensive standards for the management of IT networks, there is no certainty that these standards will be adopted in the United States or in South-East Asia and the Pacific. With a single standard unlikely to be settled for some time, the industry is forced to work with vendors' proprietary protocols in the meantime.

4.19

Accordingly, while converged networks provide a cost-effective means of substantially improving the quality of telecommunications services (particularly in rural areas where the development of PSTN networks would be cost prohibitive), any such initiatives are currently fraught with risk - given the need to "pick winners" in terms of electing which particular standards to adopt.

4.20

The emerging significance of end user devices has already propelled Microsoft into action, with its proposed ".NET" interface software. Microsoft appears to be pushing the view that a standards-driven Internet is doomed to failure, and that only a software-centric (ie: Windows-API-centric) Internet will enable software to run across all of the devices. This of course ignores the obvious conventional wisdom that open standards spread faster than closed ones.

4.21

Microsoft's fear is driven largely by the threat of wireless technology. Wireless presents the first real opportunity for mobile devices to talk directly to a server - and since Microsoft controls less than 40 percent of the servers and less than 20 percent of the handheld end user devices, wireless provides a real threat that a significant proportion of transactions will simply bypass the windows-dominated desktop PC altogether.

5. CONSTRAINTS ON THE DEVELOPMENT OF AN OPEN GRID OF NETWORKS

5.1

The limitations on the scope of interconnection result from the desire on the part of owners of ubiquitous networks to:

- limit network externalities for entrants, and
- preserve potential for cross market leverage into other markets, often through the bundling of services.

5.2

This approach to interconnection is exhibited throughout the world, and across a variety of industries that share the same fundamental economic characteristics of telecommunications networks. Clear analogies can be found in:

- America Online's attempts to limit interoperability of other instant messaging networks with its own;[8]
- Intel's successful monopolisation of the chipset market through reducing interoperability; and
- in perhaps its most famous manifestation, Microsoft's attempts to limit the interoperability of other Internet browsers with the Windows Operating system.

Each of these examples shares the fundamental characteristics of telecommunications networks - networked industries with strong network effects which create clear incentives for companies with larger networks to limit, or preferably exclude, interconnection and interoperability between networks. The operators of larger networks, discerning the distinct advantages of network effects, have clear incentives to reduce transparency, interoperability, cohesion and intelligence between other networks and their own.

5.3

If the proprietary and monopolistic tendencies of network operators remain unchecked, this raises very real concerns that consumers will not be able to realise the full potential of advanced communications services. End users are as interested (if not more) in access to new products and services as they are in price competition in existing services.

5.4

As a consequence, the central focus of competition policy in telecommunications and other high-tech markets is increasingly shifting from the traditional concern with pricing and output to a focus on encouraging innovation. Regulators and courts are beginning to develop concrete models and methods for analysing the state of innovation in high-tech markets, and the potential effect on innovation of various forms of conduct.[9] US regulators in particular have shown growing concern with the impact of firms' behaviour on innovation:

> *"...electronic commerce, as well as all commerce involving high-tech industries, may be sufficiently different to require a more careful focus from antitrust enforcers. As Chairman Pitofsky has pointed out, the "more subtle problems of antitrust enforcement must adjust to the special circumstances of high-tech industries. Among these adjustments is that the enforcement agencies need to be able to protect new methods of competition as well as the very process of innovation itself, which provides the stimulus to economic growth and increasing consumer welfare."*[10]

5.5

A very similar dynamic was identified as the primary driving force behind the DOJ prosecution of Microsoft:[11]

> *"The consequence [of not dealing effectively with Microsoft's market power] is not merely a lower likelihood of future competition in operating systems, but a lasting distortion in the path and pace of innovation to the detriment of American consumers. In an industry where the greatest benefit for consumers consists not so much of price competition but of innovation, the message the Microsoft's actions have conveyed to every enterprise with the potential to innovate in the computer industry is the most harmful of all the consequences of Microsoft's anti-competitive campaign. Microsoft's past successes in hurting firms that threaten the applications barrier to entry and stifling innovation deters investment in technologies and businesses that exhibit the potential to threaten Microsoft. The ultimate result is that some innovations that would truly benefit consumers never occur for the sole reason that they do not coincide with Microsoft's self-interest."*

5.6

Similarly, when the Australian Competition and Consumer Commission (ACCC) was required to consider the potentially anti-competitive impact of the proposed merger between the incumbent Telstra and OzEmail, a supplier of residential Internet subscriber services, the ACCC recognised that the primary concern was not the potential for monopoly pricing or restricted output, but the likely effect the merger would have on innovation in a range of dynamic and evolving communications markets.[12]

6. CONCLUSION

6.1

The steady growth of intelligent networks has been less identifiable to the public than the rise of the Internet or the mobile phone, but no less significant. However, if the proprietary and monopolistic tendencies of network operators remain unchecked, this raises very real concerns that consumers will not be able to realise the full potential of the advanced intelligent networks and the convergent services available over those networks.

6.2

There is a serious conflict emerging between:

- the demands of end users, and the scope of interconnection arrangements they will require in the future; and
- the approaches to interconnection favoured by network operators (and the incumbent networks in particular).

It is essential that this growing divide be critically assessed in the near future, or it is increasingly likely that end users will lose out and remain unable to enjoy the full functionality of computer-enabled communications services and end user devices.

6.3

Network operators must reconsider their approach to interconnection - not only to avoid the prospect of regulatory intervention (as already foreshadowed by US regulatory developments, which have extended to encompass electronic bonding) but, more importantly, to ensure that end users are able to enjoy access to advanced services, functionality, flexibility and choice.

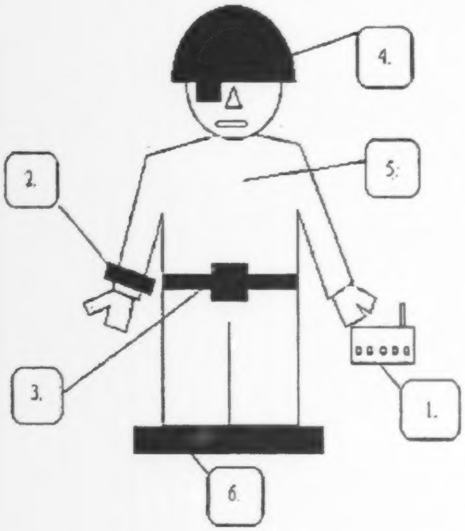
6.4

With the devolving of intelligence out to the edge of the networks, consumers will emerge as the strongest opponents of limited interconnection arrangements based on customer lock-in and closed proprietary standards. Consumers are as interested (if not more) in access to new products and services as they are in price competition in existing services. This requires a far broader approach to interconnection than we have seen to date, combined with a global approach to the standardisation of IP protocols. The focus of policy and regulation must be one of encouraging innovation, and ensuring that the significant benefits and opportunities inherent in advanced intelligent networks and end user devices are delivered into the hands of consumers. The only differentiator that is in the longterm interest of consumers is one that is based solely on quality of service.

ATTACHMENT A

THE COMPUTER ENABLED END USER

1. ***Portable device:*** Wireless internet enabled portable computer, phone, camera and scanner (widely available in near future)
2. ***Wrist device:*** Wrist computer and digital display may replace portable computer (prototypes in limited commercial use)
3. ***Wearable computer:*** Attached mobile computer (prototypes in limited commercial use)
4. ***Head mounted devices:*** Head mounted visual display unit, earphone and microphone (opaque liquid crystal eye glass or contact lens to replace early bulky prototypes)
5. ***Devices embedded in clothes:*** Computer clothes, the human body as a conductor, implantable microchips, the human skin as a visual and hearing device (early research and development phase)
6. ***Toe operated sensors:*** Shoe as computer, power source and casino aid (already banned in casinos, other aspects in research and development phase)



1. Portable device

Employing Bluetooth, wireless application protocol and smart card technology facilitates global communication between various devices and can be used:

- for vending machine purchases and internet transactions;
- to digitally record, transmit and receive visual and audio data without wires;
- to receive handwritten drawings via pen operated display;
- to transmit and receive data to and from surrounding smart environment; and
- to scan text and transfer data to a remote device in real time.

A pocket sized device can be unfolded to deliver the equivalent of a 19 inch colour monitor. Miniature earphone and voice command will eventually replace keypad entry.

2. Wrist device

Can be used with digital display to:

- continuously record interaction with people and devices on a wireless platform, storing information from smart surroundings or data received from the Global Positioning System (GPS), and will include sound, sight, smell and touch data in the near future; and
- display visual images such as text, video, maps, diagrams or photographs from commands entered on chest mounted chorded keypad, enabling for example, an underwater diver to use complex software while swimming.

3. Wearable computer

Can be connected with head mounted device to:

- provide a virtual acoustic navigation map of surroundings using GPS technology and geographical database via sound through earphone;
- digitise sensory data (from colours to emotions) allowing a person to identify the state of mind of a remote person;
- augment memory by continually listening for the context of user and automatically suggest useful information;
- analyse human voice and provide real time feedback over phone or in person to allow one person to determine whether the other person is unsure of their words or practicing deception;
- analyse identifiable character traits such as fingerprints, speech or facial characteristics; and
- record, store, analyse, receive or transmit intelligence to or from other sources in near real time.

4. Head mounted devices

Head mounted display, camera, microphone, earphone and sensors connecting to a wearable computer employing wireless communication can be used:

- to reconfigure the human visual system in greater resolution or as required;
- as a temporal visual filter to enhance light and shade and augment or diminish visual experience, providing computer induced flashbacks with annotations to aid memory;
- overlay text and graphical information on real world experience, provide 360 degree field of vision, transmit and receive images to or from other users in real time, and with thermal and image intensified technology, provide night vision; and
- capture sign language for translation by wearable computer into synthesised speech.

Early visual display units show 2D images and cover one eye. New visual displays use special glass infused with liquid crystal to give the illusion of a free floating, full sized mono-chrome or colour screen without impairing the user's vision. Contact lens or a display mounted inside the eye without touching the retina may become the future display units. Miniature bone conduction earphones and microphones may replace external phones.

5. Devices embedded in clothes

Computer circuitry, acoustic sensors and conductive (electrical and optical) materials embedded or sewn into the clothes worn by a user can be used:

- to collect and transmit data such as the direction and speed of a bullet striking the wearer;
- by a group of artists to combine and paint in virtual space as one united painter;
- to create music from the user's walk, dance or motion;
- to translate the user's words into a foreign language displayed on a shirt or issue computer synthesised voice commands;
- as a personalised radar system integrated in a close fitting vest to process objects in the vicinity of the visually challenged user by means of electric stimuli;
- monitor the user's body functions and alert pre-defined persons when a body function becomes critical;
- gather sensory impressions which can be shared with other users;
- retrieve power from the body;
- harness the conductive properties of the body to generate a low power field known as a personal area network (PAN). The PAN operates like any other wireless network and may be interfaced or connected as the user desires; and
- to reproduce in flexible form, a printed circuit board which will perform computing functions giving a whole new meaning to the term "wired".

Microchips (microprocessors) implanted in a body or thing can store, record or transmit information and can be used to:

- activate remote switches and communicate with other devices;
- record and monitor the identity and movement of a person or thing, including the maintenance of electronic accounts;
- interface with the human nervous system and activate human or artificial motor systems inside or outside the body;
- control a computer directly from the nervous system by taking measurements off muscles and tendons and feeding them into a translator; and
- in the future, as an implant behind the eye to record the user's entire lifetime of thought and sensation, allowing playback of the user's entire life and possibly conferring that experience into a new born baby.

The neurophone is an electronic interface device that can send commands to the brain directly through contact with skin. The digital neurophone converts soundwaves into a digital signal which activates the skin in a way the brain understands as if the signal was received via the ear. Humans may soon join many primitive organisms and animals which can see and hear with their skin.

6. Toe operated se[illegible]rs

Toe operated sensors in the shoe interpreted by a computer located in the shoe sole allows user (via hearing aid) to count cards in blackjack and predict outcomes on the roulette wheel. The computer in the sole is powered by the movement of the feet and may be used to improve the efficiency of the wearer's gait.

About Gilbert & Tobin

Gilbert & Tobin is a specialist commercial law firm based in Sydney, Australia. It is widely recognised as the leading 'digital economy' law firm in the Asia Pacific region. Now 300+ people after 12 years of operation, it counts as clients many of the region's most well-known brands. For further information on Gilbert & Tobin, it's people and publications visit: www.gtlaw.com.au

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[1] See further Lido Telecommunications Essentials at www.telecomwebcentral.com.

[2] Signalling systems are used to inform telephone exchanges of the important features of each individual telephone call to route calls to the correct end user device and determine the appropriate path to establish for each call.

[3] Eg: the call set-up information, routing and ongoing management, clearing of a call, billing and other information exchange functions (including customer-related information such as the identity of the caller or the choice of carrier).

[4] Prior to this, the routing of a call would utilise the trunks in all of the switching systems involved and this meant that if the terminating end was busy, all of the trunks were set up unnecessarily.

[5] For example, there is scope for incumbents to limit the value of the signalling during network transit, ie: the ISUP information provided on entry to the incumbent network is discarded and the ISUP provided at network egress reflects the boundary of the network, rather than the source of the call.

[6] Such services are bundled for large corporate customers by new integrators such as "applications service providers", with delivery via broadband access ensuring that those services can be accessed within the corporate office, at home, or in the course of business travel.

[7] Two major bodies have been involved in the development of standards: the Internet Engineering Task Force (IETF) and the International Telecommunications Union - Telecommunications Standardization Sector (ITU-T). The Internet Engineering Task Force (IETF) has also produced stable and widely implemented Internet Standards. The ITU-T has produced such standards as ITU-T, Recommendation H.323, "Visual Telephone Systems and Equipment for Local Area Networks That Provide a Nonguaranteed quality of Service"; ITU-T, Recommendation H.225, "Call Signalling Protocols and Media Stream Packetization for Packet-Based Multimedia Communications Systems"; and ITU-T, Recommendation H.245, "Line Transmission of Nontelephone Signals"). ITU-T has also issued a set of data communications standards (the X-series) in collaboration with the International Organization for Standardization (ISO). The ISO Open Systems Interconnection (OSI) suite has also heavily influenced the basic concepts and terminology presently used in the IETF. Other important standards bodies in this area include the European Telecommunications Standards Institute (ETSI) and the Institute of Electrical and Electronics Engineers, Inc (IEEE).

[8] Instant Messaging (IM) is a service which allows an Internet Service Provider (ISP) to detect when a user is online. Instant Messaging Users establish "buddy lists" of people who's online presence they wish to track. Users can therefore be informed when their buddies are online. AOL first introduced the service in 1998 in the United States, quickly developing a large online network of instant messaging users, and therefore the clear incentive to limit interconnection and interoperability with competing services. Microsoft introduced an IM service in mid 1999 which provided compatibility with AOL's IM service and users

[8] A month after the Microsoft launch, AOL re-programmed its service, making it incompatible with users on Microsoft's IM network. Microsoft re-programmed its service to be compatible with AOL's again, but again AOL shut out Microsoft users. This scenario has been repeated a number of times, not only with Microsoft, but Yahoo, Excite, Multimate, Odigo, iCAST, KOZ.com, and AT&T all seeking to gain interoperability with AOL's service, and being excluded. This has allowed AOL alone to benefit from the positive network effects of its large IM user base. IM is increasingly becoming a service of great interest to end users - there are currently more than 130 million instant messaging users worldwide, and more than 3 million users signing up for instant messaging every month. Over 1 billion instant messages are sent every day, far more than the entire mail volume of the U. S. Postal Service. But the incredible potential of this emerging service cannot be fully utilised by end users because the service is still not interoperable, and these end users simply cannot communicate with each other unless they all join the same IM network.

[9] See, for example, FTC, Competition And Consumer Protection Policy In The New High-Tech, Global Marketplace, Available at: http://www.antitrust.org

[10] David A. Balto, "Emerging Antitrust Issues in Electronic Commerce", Assistant Director, Office of Policy and Evaluation, Bureau of Competition, Federal Trade Commission, 1999 Antitrust Institute, Distribution Practices: Antitrust Counseling in the New Millennium, Columbus, Ohio, 12 November, 1999. http://www.ftc.gov/speeches/other/ecommerce.htm

[11] Department of Justice, Plaintiffs' memorandum in support of proposed final judgment, at 28.

[12] The Commission stated in its preliminary advice that:

"It is possible that the proposed acquisition could have a detrimental impact on the competitive dynamics for Australian online content, online advertising and electronic commerce. These Internet markets are still in the early stages of development in this country. The emergence of a dominant Australian ISP could retard competition and stifle innovation in these evolving markets'. ACCC, Telstra/Ozemail Preliminary Advice, Press Release, 28 January 2000.

Back to top of page **Back to the sessions page**

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Bernadette Jew practices in the areas of communications law, information technology and trade practices.

Bernadette advises carriers, internet service providers (ISPs), applications service providers (ASPs) and large corporate customers on a wide range of commercial matters including the implementation of large-scale alliance arrangements, service levels, software licensing, and other general commercial issues arising in the course of e-commerce and e-procurement transactions and the delivery of ASP services.

In the telecommunications area, Bernadette advises on matters relating to network infrastructure access and broadband services, including large-scale wholesale transmission capacity arrangements, Internet charging arrangements, local loop unbundling and local call issues. She has participated in various industry forums focusing on those issues.

Bernadette has also worked on a number of major systems integration and outsourcing projects, as well as projects involving technology transfer and technology-based equipment and services. She has also been involved in the resolution of a number of disputes relating to the implementation of systems integration projects.

In 1999 Bernadette attended an Executive Program at the John F Kennedy School of Government, Harvard University entitled "Infrastructure in a Market Economy". This program focused on effective policies for implementing and regulating the private provision of infrastructure.

Bernadette has written and presented numerous papers and articles on communications, Internet, e-commerce and information technology. She presented papers to the Pacific Telecommunications conference in January 1999 and February 2000. Bernadette also presented at a forum on Internet charging conducted by the APEC Telecommunications Working Group in March 1999 at Miyazaki, Japan. Earlier this year she presented at the ASP 2000 Summit in Melbourne.

Back to proceeding page **Back to the sessions page**

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Angus Henderson is a partner with the Australian law firm Gilbert & Tobin. He holds Bachelor of Science and Bachelor of Law degrees from the University of New South Wales.

Angus specialises in telecommunications, broadcasting and competition law. He acts for clients such as Optus Communications, Hongkong Telecom, Singapore Telecom and Sri Lanka Telecom. A large amount of Angus' practice is devoted to interconnection and access issues and the development of regulatory models in the telecommunications and broadcasting industries.

In particular, Angus has provided ongoing advice and assistance to Optus on all of its regulatory issues including their arbitrations before the ACCC. He also advises the Optus interconnect and wholesale sections in their commercial dealings with other operators.

Angus also advises Sri Lanka Telecom on all aspects of telecommunications regulation in that country. He also advise Singapore Telecom on their interconnection arrangements in Singapore and in preparation for open competition from 1 April 2000.

He has also advised Hongkong Telecom in its transition to open competition in the domestic services market and has assisted with the interconnection negotiations in Hong Kong.

Angus is a regular speaker at communications, broadcasting and technology conferences in Australia and has presented papers in the Philippines, Indonesia, Malaysia and Singapore. He is co-editor of Communications Law and Policy in Australia.

Back to proceeding page **Back to the sessions page**

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Rob is a non-lawyer partner with Gilbert & Tobin. He is a communications specialist and has knowledge, skills and contacts built up in an 18 year career in business, focusing on strategy and telecommunications. He specialises in delivering strategic direction and associated solutions. Rob has proven commercial, finance and analytical abilities and an extensive technical and regulatory background. This ensures that his solutions are practical and appropriate.

Rob has experience in the Australian telecommunications industry with particular strengths in strategy development and regulatory change management. His experience is with carriers, broadcasters and suppliers in various markets.

In addition, he has worked in the USA for Century Communications on cable, mobile, telephony and Internet delivery.

Rob has an honours degree in Electronics and Communications Engineering and has developed a number of specific business skills including:

- an understanding of strategic imperatives in convergence;
- strong commercial orientation;
- presentation skills;
- project management; and
- the ability to operate multi-threaded projects and maintain correct priorities.

Rob understands situations where accurate definition and implementation of strategic goals must be achieved in a short timeframe and under pressure. He particularly enjoys the interpretation role of transforming multiple changing priorities in an organisation into a coherent and unified strategy. He is also used to working in times of rapid change and understands that one of the key requirements to achieve ownership of strategies is the communication of changes in a consistent way.

Back to proceeding page **Back to the sessions page**

Next Generation Networks and Services

Peter Falshaw

Abstract

www.ovum.com

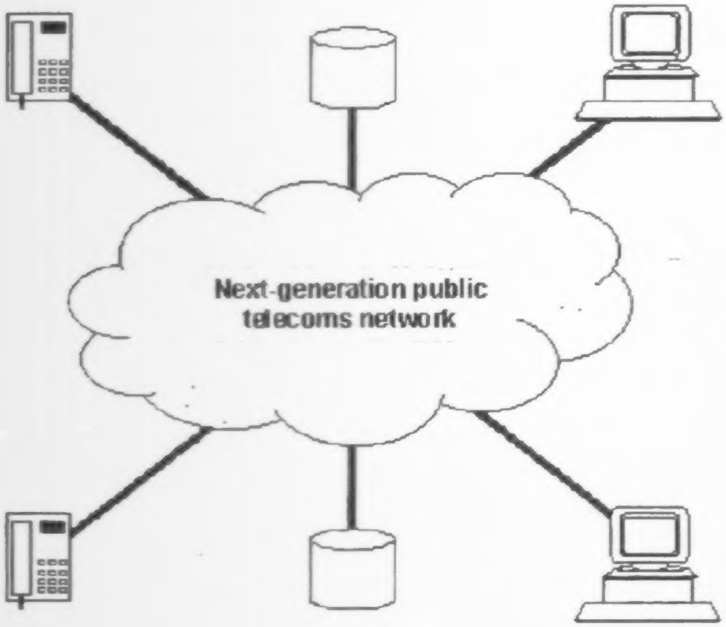
1. What are Nextgen IP networks?

Next-generation (Nextgen) networks are based on Internet Protocol (IP) packet switched technologies. They are networks that fully address the ubiquitous digital environment and service convergence.

Traditionally, public switched telecommunications network (PSTN) operators designed and operated their networks to address the needs of analogue voice communications services which were narrowband in nature. For this task, circuit switched technologies were adequate. However, there has been an ever increasing need for broadband data communications services for computer communications, and these services did not sit well in circuit switched networks optimised for voice communications. The short term answer in the 1980's and 1990's has been to build overlay or dedicated networks, such as X.25, ISDN, Frame Relay and ATM networks to meet the requirements of mainly business customers for data communications.

The explosion in demand for data services, starting in the mid 1990's with the widespread adoption of the Internet, and significant technical advances in switching and transmission technologies, paved the way for new integrated approaches. In developed telecoms markets, network and service convergence is becoming a reality through Nextgen networks.

Figure 1: Nextgen networks: one infrastructure but multiple services



- Consistent availability & performance
- Class-of-service differentiation
- Reliable quality of service for each defined traffic type:
  - voice
  - video
  - Internet access
  - private data
  - etc...

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Source: Ovum - Next-generation IP Services: Business Strategies for Voice-Data Convergence

As depicted in Figure 1 above, Nextgen networks are single multi-service networks that carry voice, data and video bitstreams using Internet Protocol (IP) over common transmission links and routers. They have the following characteristics:

- no separate voice and data networks
- no overlay networks for different services
- all voice, data and multimedia traffic is carried as packets on IP backbone networks, with appropriate quality and class of service for each traffic type
- services are logically implemented on platforms that are separate from the transport and access layers of the network.

Over the past ten years there has been phenomenal growth in the level and the breadth of Internet usage, by individuals, public organisations and businesses. In the case of organisational usage, the consequent surge in intranet and extranet adoption has led to widespread use of IP in both private and public networks.

The ubiquity of IP is now such that it can be considered the *de facto* global standard for data networking: it is unstoppable. The lack of private ownership of IP and its associated protocols means that it can also be considered an open standard - at least by the standards of the telecoms industry. The number of IP connectivity points, IP software developers and the amount of IP-based content (and the rapid growth of all three) make IP the clear choice for the basis of future unified voice and data networks.

2. Drivers of Nextgen IP networks

There are a number of key drivers for IP networks. They include:

- the data wave
- competition
- IP telephony

The rise of data in telecoms networks

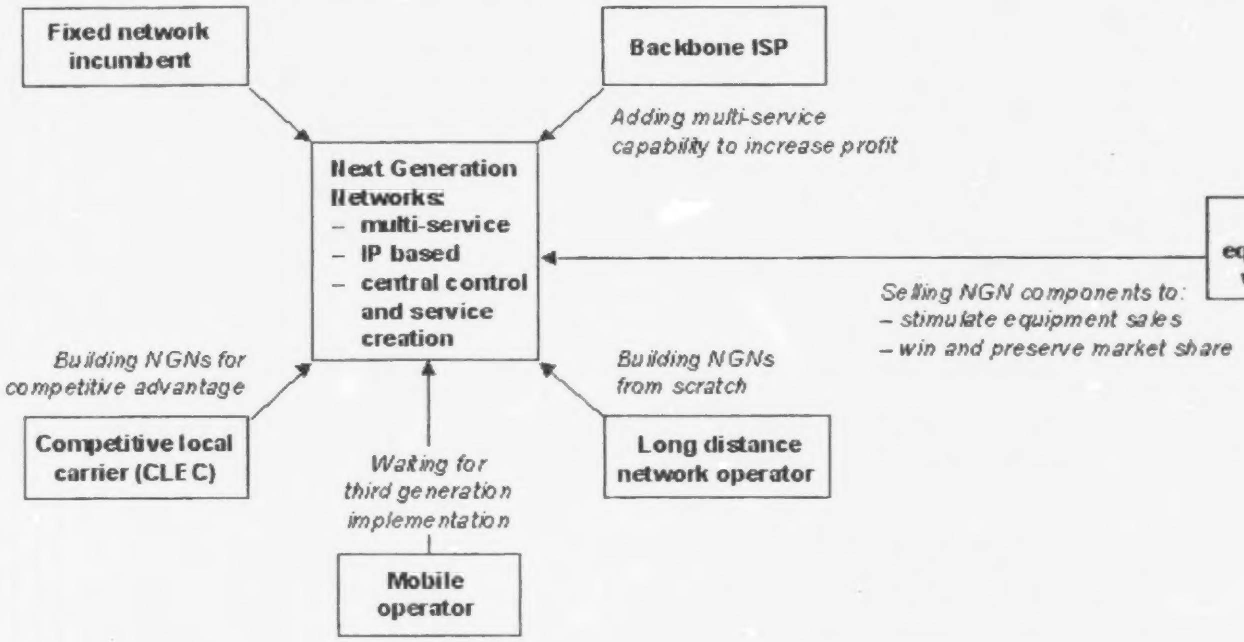
The use of the Internet and of corporate data communications has undergone explosive growth during the 1990s. This is fuelling a surge in the proportion of total telecoms traffic that is accounted for by data rather than voice. In some telecoms carrier networks, the majority of traffic is already data, and this situation will become the norm in developed markets during the early 2000s.

The 'data wave' is the primary driver of unification in next-generation networks and services. The PSTN was not designed to carry data traffic and is in danger of being overwhelmed by the data wave. Telcos therefore need to migrate from operating voice networks that also carry data, to data networks that also carry voice.

The spread of competition in telecoms markets

Liberalisation of telecoms has spread to most of the developed world, and many of the less-developed countries. In advanced competitive markets, such as the US, there are now many different types of telecoms carrier competing in a variety of market sectors. Local and long distance operators and Internet Service Providers (ISPs) are all investing in Nextgen networks. But, as illustrated in Figure 2 below, their start from very different positions and consequently their strategies for using Nextgen networks are quite different.

Figure 2: Nextgen strategies of the various players


Fixed network incumbent
Backbone ISP
Adding multi-service capability to increase profit
Next Generation Networks:
– multi-service
– IP based
– central control and service creation
NGN equipment vendor
Selling NGN components to:
– stimulate equipment sales
– win and preserve market share
Building NGNs for competitive advantage
Building NGNs from scratch
Competitive local carrier (CLEC)
Waiting for third generation implementation
Long distance network operator
Mobile operator

Source: Ovum - The Business Case for Next-generation IP Networks

Competitive local exchange carriers (CLECs) - choose Nextgen networks to reduce their costs and increase potential revenues per customer.

Fixed incumbents - face the prospects of rapidly declining profits due to loss of market share from new competition and the transfer of voice traffic to mobile networks. They need to start building Nextgen networks to reverse this decline, but legacy systems and thinking are a significant handicap

Long distance carriers - have different needs, depending on whether or not they operate at the wholesale or retail level. Large wholesale long distance carriers are now building high bandwidth regional and global networks and Nextgen networks are essential to keep unit costs down. Retail long distance carriers are building Nextgen networks mainly to offer IP VPNs to large corporate customers.

Backbone ISPs - face increasing competition from long distance Nextgen operators. Nextgen networks offer new opportunities for backbone ISPs to offer multi-service capabilities and to access new voice based revenue streams.

Mobile operators - will use Nextgen networks to upgrade their core networks but will not move to end-to-end IP networking until they have finished building their 3G networks.

In the competitive environment, therefore, telecoms service providers need to:

- reduce costs - a unified network carrying all services will avoid multiple expenditure on investment, maintenance, management and training
- operate efficiently - next-generation networks will simplify the interactions that take place between traffic, signalling and network equipment
- respond more flexibly to market conditions - service providers need to innovate continuously in order to compete on value instead of price. Next-generation networks will make it faster, easier and cheaper to create, modify and customise services.

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Voice over IP

The data wave and telecoms competition are both driving the unification of voice and data; the third catalyst - packet-switched voice - is enabling it. Packet switching as a mode of data transmission first appeared in the early 1970s. In the mid-1990s, the speed of packet-switched networking equipment started to become fast enough to consider using it to carry real-time traffic such as voice. In the last two to three years, rapid development of packet voice technology has taken place - particularly voice-over-IP (VoIP).

VoIP is a fast-moving target. From 1997 it transformed from a technologist's hobby into a fledgling alternative public network service, allowing providers to avoid the pricing structures and regulations that apply to telephony services. The market is now well aware of VoIP as a toll-bypass service and, even in the absence of solid, scalable interoperability standards, wholesale VoIP services approaching PSTN quality are becoming available.

In the meantime, VoIP has moved on again. There is now the imminent prospect of being able to provide a high-grade, fully-featured voice service over IP networks. This makes it a key enabling technology for unified voice and data networks

The competitive imperative

Service providers operating in competitive markets cannot afford to be slow or inefficient. Next-generation services have several characteristics that will directly enhance the ability of all types of service provider to be fast and lean in an increasingly competitive environment.

Rationalise networks and services

A service provider operating a single network infrastructure for all service traffic can achieve major savings in its operating costs. The next-generation concept is designed to reduce, and ultimately eliminate, the need for overlay networks. A single, unified transport and switching network will carry all types of service; the logic in which they are implemented will reside on servers at the network edge.

Service providers will be able to introduce new services without incurring the extensive cost of an overlay network. This will make it cheaper and easier to develop and innovate in response to customer needs.

Reduce the cost of network construction

The cost of constructing an IP voice network is approaching the cost of its circuit-switched equivalent. As the price of packet switches continues to fall much faster than that of circuit switches, and as industry standards emerge for gateway equipment, it will soon be considerably cheaper to build an IP voice network. Next-generation networks can thus minimise the overhead involved in acquiring or defending market share. For instance, in mid-1999, BT Spain announced that it intends to build a new national IP telephony network. It stated that it expects to build the voice-switching layer of the network for 50% less than it would have cost to use circuit switches.

Add value to commoditising services

There is heavy downward pressure on phone charges in competitive markets. Even some advanced services (such as freephone) are becoming commodities. In order to avoid being dragged into a price war, service providers need to find new ways to add features and functionality to their core services. Next-generation services offer a wide scope for this. For example:

- by implementing Centrex-over-IP, enhanced features such as directory-enabled dialling and PC-controlled conferencing become possible
- by bundling web and call centre gateway services, service providers can add value to freephone and shared-cost

services - for which call centres are one of the principal markets.

Reduce time to market

The next-generation model of service creation fully decouples the creation and operation of service logic from the core switching fabric. Services in next-generation networks will be created on computer servers based on open standards, and will control the network via APIs. In this way, service providers' competitiveness will be boosted by:

- getting new services to market faster
- making it easier and cheaper to target niche markets and single customers
- fostering the growth of a third-party service development industry, the products of which can be rapidly used by service providers.

Enhance service marketing

Next-generation services will increase service providers' scope for innovative packaging and pricing. For example:

- fee-based pricing structures, such as a fixed monthly charge for a given amount of bandwidth, become more feasible. Many customers prefer this to usage-based pricing, as it makes costs more predictable and controllable
- customers can be targeted with integrated service bundles, with discounts for the `component' services being more than offset by the increase in total revenues. Voice could even be offered `for free' with premium data services
- services can be developed that require a substantial amount of customer commitment to set up. Such customers will need a very strong incentive to consider switching to an alternative supplier.

Position for e-commerce

Service providers need to start establishing a market position in anticipation of the rise of e-commerce. An early presence will benefit service providers by building experience and creating brand recognition.

Next-generation services offer great potential as part of a leading-edge e-commerce strategy, because of their capability to:

- vastly extend the reach of electronic trading systems. Their connectivity with potential customers and trading partners far out-strips that of any other type of data network, in terms of both quantity and diversity
- enable a range of different modes of interaction. This gives wide scope for enhancing the experience of customer contact and for supporting e-commerce services with value-added content.

3. Nextgen services - how will they differ?

Next-generation networks and services address some of the most urgent needs faced by service providers and their business customers. An increasing awareness of their capability to meet these needs will be the key to unlocking demand for next-generation networks and services.

Support new ways of working

Business users increasingly need simple and flexible ways to control access to communications and information resources from a range of locations. By carrying multiservice traffic over IP networks, service providers can better support the needs of their customers in this area. Trends that are expanding those needs include increasing numbers of:

- mobile workers
- home-based workers and `hot-deskers'
- workers that frequently change their working location

- organisations with flatter, more flexible structures in which teams are frequently set up and disbanded on a project-by-project basis
- companies that use large numbers of freelancers and associates instead of permanent staff.

Gain direct control over service usage and management

Next-generation services make it easier for service providers to offer their customers self-provision and self-configuration of services. In the next-generation network, this will not require the service provider to give customers direct access to the switching and transmission equipment. Users can be given the capability (via web-based interfaces) to add capacity and facilities, and to alter features such as numbering plans, wherever and whenever the need to do so arises. Users will benefit by avoiding the need to request such changes from the service provider, thus avoiding the resulting delays and charges.

Service providers can also benefit from self-provision and configuration. It offers them the opportunity to eliminate the overheads associated with carrying out customer requests.

Make communications more interactive

By combining different types of media and increasing the scope for interaction between them, next-generation services offer service providers scope to enhance their customers' experience of communications. They can be used as a means to:

- improve levels of customer service - for example, web-enabled call centres can enable customers' queries to be dealt with more effectively by referring to visual material
- enhance the richness of service content, making e-commerce activities more effective
- increase personal productivity by allowing a wider range of tasks to be carried out from a single location.

4. Emerging next-generation service types

Although the market is currently at a very early stage of development, some important types of next-generation service are starting to emerge. We group these early services into three categories:

- access services
- interconnectivity services
- application services.

Access services

This type of service offers the user a single, unified connection to the network for multiple communications services - for example, voice, data and Internet access. It may also incorporate some functionality to give users direct control over provision and configuration of bandwidth and other resources. The primary benefits that next-generation access services will offer users are:

- simpler management and administration of the company's telecommunications
- lower cost of service, compared with the total cost of the individual service connections replaced by the integrated connection.

Interconnectivity services

This type of service adds customer-specific connectivity and switching functionality to unified access, enabling user groups and dialling plans that apply to multiple services. There are two types of next-generation interconnectivity service: IP VPNs and IP Centrex. In both cases, the major benefit offered to users is an increase in the flexibility with which a company's information and communications resources can be accessed by its workforce (and, in the case of IP VPNs, by its trading partners and customers).

Application services

Application services provide sets of capabilities that address the needs of a particular business function or type of organisation. The benefits that they offer to users vary, depending on their features and the particular market at which they are targeted. Three early types of application service that are becoming important are:

- web-enabled call centres - services that support the functional integration of these two types of customer interface
- unified messaging and call management - services that integrate the management and access of multiple message types, and enable users to handle incoming and outgoing calls via their computers
- multimedia conferencing - services that allow users to simultaneously converse and share & modify electronic documents.

Next-generation applications will become a large and diverse category of services, as widespread and mature next-generation infrastructures make innovative service development faster and less expensive.

5. Obstacles to be overcome: Price, service and migration issues

Although next-generation services offer a wide range of important benefits for both service providers and their customers, the way is not yet clear for the market to take off. Several issues concerned with the marketing and technical implementation of services need to be addressed before substantial expansion can take place in next-generation services.

Marketing obstacles

Next-generation services are complex

The capabilities offered by next-generation services are diverse and fairly complex. It takes a lot of explaining to convey to customers what, for example, an IP VPN is and what it can do for them.

Service providers therefore need to make their marketing messages for next-generation services as clear as possible. In particular, they must get users to think of them in terms of benefits, instead of technologies. Giving prospects the opportunity to try out services will also be an important part of the selling process.

Internet is perceived to mean low prices and low reliability

The Internet has a culture of cheap or free services. Its history as a `best-efforts' infrastructure also means that many business users do not perceive it as a medium for mission-critical data. Service providers will seek to market next-generation services to business customers at premium prices, so they must emphasise that next-generation services run over reliable, high-performance IP networks - rather than the low-performance, best-efforts Internet. Specialised features, functionality and content will also help to break the association of next-generation services with the Internet.

Conflicts of interest for service providers and vendors

These will include:

- revenue cannibalisation - next-generation services can substitute for some existing, higher-tariffed services
- internal politics - next-generation services blur the boundary between data and voice services, and will therefore cause some organisational disruption as the market develops
- inertia - until IP is widely accepted as a medium for premium business services, sales people will often find it easier to concentrate on selling existing, well-established services.

Technical obstacles

Progress is still needed in key areas of technology for IP networks to carry business-grade voice and multimedia services. The supporting technology needs to be improved in a number of important ways before pure-IP networks can deliver an alternative public communications infrastructure.

Latency

In order to carry real-time services such as voice and two-way video, IP needs to support a consistent, guaranteed delay of well under 200ms from end-to-end.

Class of service

Different types of service traffic have different performance requirements. For example, IP networks need to be able to tell the difference between an inter-office e-mail and an electronic funds transfer, and to treat them appropriately.

Calling features

Phone users expect features such as caller ID, messaging and freephone. They will not consider a VoIP service to be a viable alternative unless it is able to provide equivalent services.

Scalability

The only standard for VoIP interoperability that is currently useable, H.323, was originally designed for LANs. Much work is needed on the standard to scale it up for carrier network deployment without requiring prohibitively complex installations.

Billing

Sophisticated billing systems have been developed for telecoms networks, supporting a variety of customer options and carrier-pricing structures. Internet charging models have been very basic up to now, and a great deal of work is required to develop systems to support the type of sophisticated billing found in the PSTN.

Reliability

Telecoms switches have a reputation for being `bullet-proof' - they do not break down and their software does not crash. Data networking vendors have a long way to go before they will be perceived in that way.

Security

Privacy regulations and the need to protect commercially sensitive information have led to a trusted framework for security over telco data networks. Much progress is needed in IP networks before customers consider their security adequate.

6. Conclusions

The key conclusions from our research into the development and implementation of Nextgen networks are:

- New entrants are not investing in circuit-switched networks - they are exclusively operating in a nextgen IP planning and operating mode.
- The technical and marketing obstacles to IP services will be solved.
- Suppliers are also looking forward to an entirely Nextgen IP network environment, and will reduce their support for

circuit-switched network operations accordingly. As a result the cost of maintaining traditional networks will increase substantially over the next few years.

- Incumbent operators are planning the difficult transition to IP networks, and making hard decisions that could adversely affect their existing customers. Most are ignoring the option of slow and seamless transition.
- Incumbent operators who are not positioned in IP within the next few years will not survive.
- Circuit-switched networks will be displaced and phased out. This process will accelerate and be largely complete in most developed economies by 2007.
- Pricing and product definition will be radically transformed, and reflect the imperatives of the Internet IP world. Existing value propositions will need to be drastically re-thought.

Ovum Reference Reports:

The following Ovum reports provide further information on the development and implementation of Nextgen networks:

1. Next-generation IP Networks - Service Opportunities from New Platforms by Iain Stevenson and Edward Pugh, Copyright © 1999 Ovum Ltd
2. Next-generation IP Services - Business Strategies for Voice Data Convergence by John Delaney and Peter Hall, Copyright © 1999 Ovum Ltd
3. The Business Case for Next-generation IP Networks by David Lewin and John Delaney, © 1999 Ovum Ltd

Back to top of page **Back to the sessions page**

Peter Falshaw

www.ovum.com

Peter Falshaw is the Director of Ovum's Asia Pacific consultancy practice and is based in Sydney. He has twelve years strategy and general management consulting experience specialising in the telecommunications industry with Ovum and Price Waterhouse. He has also had substantial business and consumer marketing and business development experience in telecommunications with Telstra and Alcatel.

Prior to joining Ovum in 1996 Peter was senior manager with Telstra responsible for the product management of dedicated network services. He has extensive and contemporary knowledge of carrier network costs, tariffing, marketing and regulatory issues for fixed narrowband, broadband and mobile networks.

Within the past four years Peter has been involved in a wide range of business case development, marketing and regulatory studies for carriers, prospective carriers, governments and regulators in Australia, New Zealand, Hong Kong, Singapore, Taiwan and Korea.

His recent consulting clients include: ACCC, ACA, BT , C2C Networks, DGT Taiwan, GAIL India, Lucent Technologies, Ministry of Commerce New Zealand, NextGen Networks , The National Office of the Information Economy (NOIE), One.Tel, OFTA, PowerTel, Reliance India, SK Telecom Korea, Telstra, Telecom New Zealand and Vodafone.

Peter has BA (Honours) Degree in Economics from the University of Leeds and a Master of Commerce Degree in Marketing from the University of New South Wales.

Back to proceeding page **Back to the sessions page**

Localizing the Global Internet: Improving Cost of Access and Quality of Service for Asia

Randy Zadra

This paper examines the growth of the global Internet infrastructure and how it has evolved in a fundamentally different way than the global Public Switched Telecommunications Network (PSTN). The focus of this paper is on the global infrastructure development as it is related to the distribution of Internet content worldwide with a particular focus on Asia — the region of the world with currently the highest Internet growth rate.

Largely due to the historical roots of the internet, as well as regulatory and policy reasons, it is argued that the global internet backbone needs to evolve from a USA centric hub which is in the process of large scale transformation in order to met the mission critical requirements of an e-commerce based society. Speed and reliability have become critical elements which global users now demand, and this requires a continued fundamental shift in the global internet backbone architecture.

The growth of the global backbone is assessed and outlined in four distinct phases.

Phase I - 1995-1998 — The Start of the Global Internet Backbone

When the internet was first developed it grew as a result of the pioneering work of the National Science Foundation in the USA, and consequently was created as a network of networks which was interconnected through what became known as peering points such as MAE-east and MAE-west. To access the internet in its basic fashion, Asian ISP's, and indeed others around the world largely followed a model of procuring private lines to interconnect to the US peering points. These private lines were purchased from the major carriers, based on the traditional "half circuit" principle of international telecommunications. Major US based carriers such as Sprint, MCI Worldcom and Teleglobe saw their revenues related to international Internet connectivity skyrocket between 1995-1998 — the key years.

Because Asian carriers were not authorized to operate the US portion of the half circuit until the recent deregulation, significant fees were paid and to some extent continue to be paid to US based carriers to access what supposedly was a free Internet. In this first phase, worldwide requests for Internet content or sites were largely routed through the USA. A significant amount of work and analysis has been carried out by both APEC and the ITU on this subject and this is looked at in some detail. Ironically this scenario while providing a quick way to access the global internet, also meant that domestic content was often transported to the USA in order to be handed off to another domestic network. While this method of connection provided quick and ready access to the global internet backbone, this resulted in many carriers, in effect paying for international circuits to transport their own domestic content.

While somewhat inefficient both from a cost and quality perspective this routing method served very well to provide quick access to the vast pent up demand. While architecturally deficient, the benefits of simple connection far outweighed the lack of elegance in exchanging traffic and ensuring quality of service.

Phase II 1998-2000 — Regional Exchanges:

As the growth of the global internet continued to skyrocket, Asian ISP's and carriers began to address the issue of how traffic could be exchanged locally — that is to say in region. The disadvantage of transporting traffic to the USA only to have it returned to the origin country readily became apparent. Hence began the focus on exchange of content domestically or in region via internet exchange or peering points. The first emphasis has been on regional exchanges, so that regional traffic remains in region. The growth of Internet exchange points such as STIX in Singapore and the Japan Internet exchange are examples of this.

The Asian exchanges offer ISP's a means to exchange traffic at least in region if not locally rather than to exchange traffic in the US, and incur the cost of the aforementioned private lines to reach the US exchange pints, and the inefficiencies associated with traffic latencies of this means of connectivity. As an offshoot of this, attention quickly shifted to the establishment of in country peering points, where by domestic traffic is exchanged in country rather than regionally or in the USA based peering points. This step however has been hampered in many countries by the lack of competition and the unwillingness of many dominant PTT's to peer with newly established service providers. The deregulation of telecommunications services in many countries such as Hong Kong, Japan, and Korea, quickly lead to the bilateral necessity to open the local peering points due to the rapid success and the amount of traffic carried by new network.

While local peering is effective in keeping traffic local, it is only a first step in the "localized distribution of the content" and the emergence of a superior quality of internet service. Local peering has addressed some of the cost issues and partially addressed the quality of service issues as related to the minimization of international router hops. Local peering points have not however totally solved the "localization" and personalization of content issues.

Phase III —2000- The rise of Hosting Centers:

In the last several years both in the USA and many parts of Asia, hosting centers or data centers have made an important impact in terms of how internet traffic is exchanged and routed. The rise of the hosting center has been largely driven by the need to locate servers or store original content close to large quantities of available bandwidth, with extensive public and private peering among networks.

While the trend of building hosting centers began in the USA, more recently data center build outs have begun in Europe and Asia through companies such as Iasia. Hosting facilities typically provide enhanced internet performance by allowing content publishers to pick preferred carriers, provide robust security, offering private networks, and also comprehensive monitoring.

While hosting centers do improve internet routing, security, and monitoring of web sites there are limitations from an economic perspective, in that the web site owner must replicate and continue to manage of his servers, which is a difficult situation to manage globally for many companies.

In order to reach a highly efficient and locally ubiquitous network, in addition to local peering arrangements where traffic is exchanged, the actual content servers must also be hosted locally, preferably at exchange points, but as a minimum with access to local peering connections. In effect this scenarios still requires the content owner to manage server deployments, locations, and integration. Local hosting centers, and peering points have not however totally solved the "localization" and personalization of content issues.

Phase IV — 2001 -The Global Multicast Edge

Many studies now reveal that despite very large backbone connections, hosting centers, and local peering, quality problems internationally and in Asia have actually increased. Internet based e-commerce opportunities are being negatively influenced by the "world wide wait". Some studies indicate that over $4.5 billion is lost yearly due to inadequate internet performance. Additionally international bandwidth costs remain high, and download times remain very high.

So while cost of access continues to be a fundamental issue, the additional issue of service quality is now a top concern.

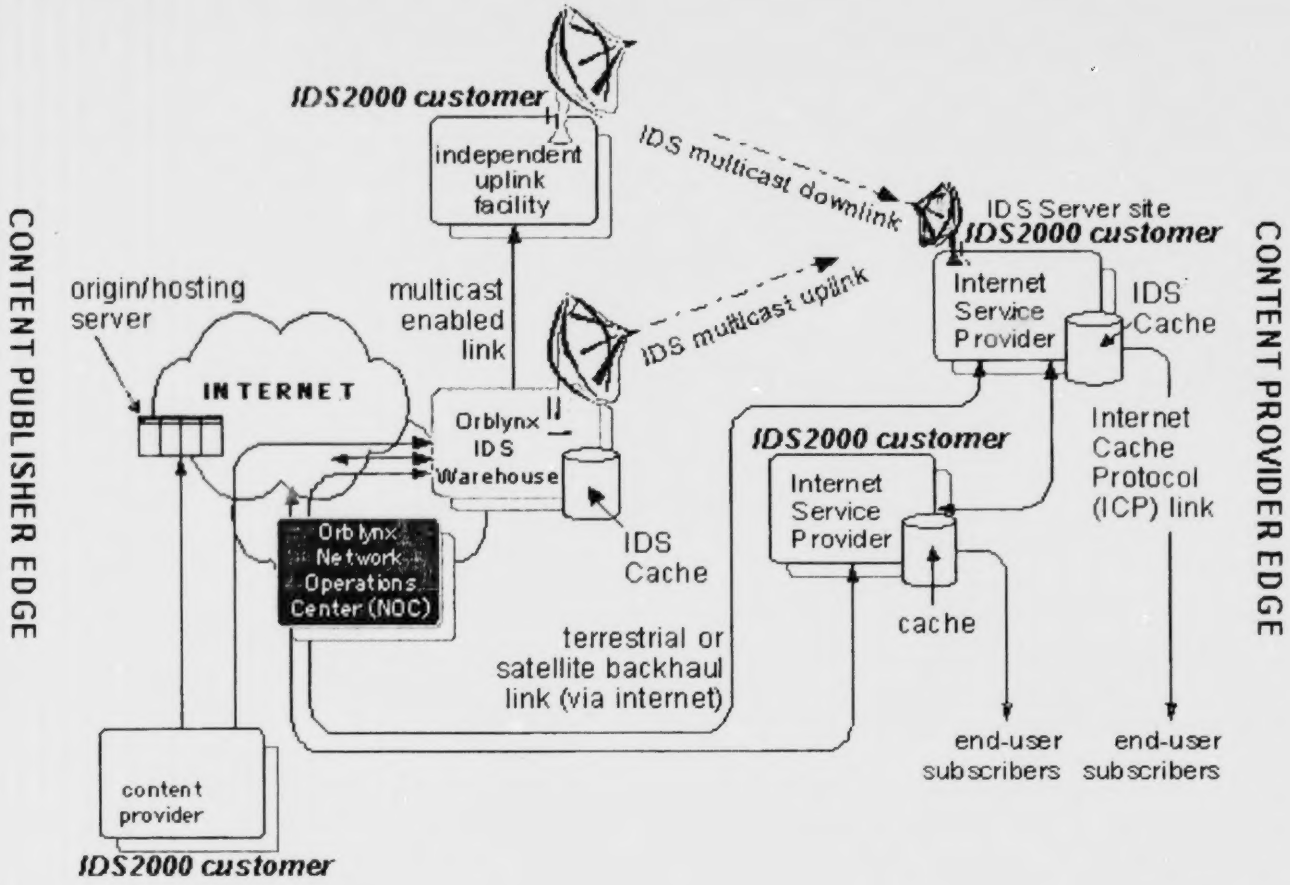
As described above, initial solutions to this problem were pursued as a first step through regional exchanges and local peering, but this has not been sufficient in resolving the problems.

The most comprehensive solution to these issues can be achieved by service providers if the architecture to alleviate congestion at both edges of the network-at-large is achieved. This is what is known as a full edge-to-edge content distribution service — with the aim of linking the content providers directly with local points of presence under the control of Internet service providers.

The establishment and operations of a global, satellite-based distribution network which is designed to deliver Internet content between intelligent caching servers located at both edges of the Internet is the next step in finding improved solutions for internet connectivity and performance in Asia.

A global Internet overlay network, can be a cost-effective distribution platform offering both unprecedented bandwidth savings and lightning-fast Internet access. Using point-to-multipoint distribution this architecture is comprised of two key elements. A large staging node located at the content publisher edge, which categorizes, refreshes, and distributes the content via satellite to intelligent servers located on the ISP nodes throughout Asia.

The staging center, a large content repository that holds a superset of content destined for caches a the edge of the network pulls popular content from the Internet and receives content from subscribing content publishers, classifies it and caches it. This content is then pushed via satellite to intelligent servers on ISP nodes. An adaptive refresh algorithm is responsible for ensuring that any object change at the origin server is captured and that all of the local server caches are updated with relevant content. An illustration of this is found below.


IDS2000 customer
independent uplink facility
IDS multicast downlink
IDS Server site
IDS2000 customer
Internet Service Provider
IDS Cache
CONTENT PUBLISHER EDGE
CONTENT PROVIDER EDGE
origin/hosting server
INTERNET
multicast enabled link
IDS multicast uplink
Orblynx IDS Warehouse
IDS Cache
Orblynx Network Operations Center (NOC)
IDS2000 customer
Internet Service Provider
cache
Internet Cache Protocol (ICP) link
terrestrial or satellite backhaul link (via internet)
end-user subscribers
end-user subscribers
content provider
IDS2000 customer

The local cache always has updated content without submitting requests to the origin server.

Simultaneously, end user statistics are collected from each local server by the staging center and scanned to determine what newly popular content or updates should be added to the common pool of web pages that the staging center profiles and distributes.

A number of ISP's and carriers including Cable and Wireless, Time, and Globe are benefiting from this type of internet architecture. It is envisaged that caching and multicasting will play an important role in the continued growth of the internet and Asia.

Back to top of page **Back to the sessions page**

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Randy Zadra is currently President of Orblynx Inx. a global Internet content distribution company.

Prior to joining Orblynx he held various positions at Teleglobe, and was one of the founders of Teleglobe USA. Mr. Zadra has also worked as an independent telecommunications management consultant. He has also served as a senior trade policy analyst with the Department of Industry in Canada, and a member of the negotiating team for the North American Free Trade Agreement.

Back to proceeding page **Back to the sessions page**

Social / Cultural

Tuesday, 16 January 2001
1430–1600

T.3.1 Go into the Cultural Online Technology

Location: Honolulu Suite

Chair: BRUCE DRAKE, Executive Director Pacific, Industry Canada, *Canada*

T.3.1.1 Distance Learning for Chinese as a Foreign Language Between China and Japan– A Case Study
(*ABSTRACT*)

QIU ZHIPU, Department of Chinese Language & Literature and NAMBA MIYUKI, International Scholars & Students Department, Nanjing University, *People's Republic of China*

T.3.1.2 Invasion or Giving Up of Internet Privacy?: A Personal Divide Emerges (*ABSTRACT*)

JISUK WOO, Assistant Professor, Department of Communication, Seoul Women's University, *Republic of Korea*

T.3.1.3 An Experiment of Cultural Heritage Presentation System (ABSTRACT)
(moved from T.3.2 - Application Implication)

NOBUYOSHI TERASHIMA, Dean, Graduate School of Global Information and Telecommunications Studies, Waseda University, *Japan;* LALITA RAJASINGHAM and JOHN TIFFIN, Victoria University of Wellington, *New Zealand;* ANNE GOOLEY, Queensland Open Learning Network, *Australia*

Distance Learning for Chinese as a Foreign Language Between China and Japan -- A Case Study

Qiu Zhipu and **Mamba Miyuki**

Abstract

www.nju.edu.cn

Distance learning, using the newer instructional technologies and multimedia, is becoming increasingly popular as an alternative method of instruction throughout the world. In China educators, mainly in colleges and universities, began developing distance learning courses during the last decade. At the beginning of the new millenium there are now more than thirty universities and some middle schools where distance learning courses are offered.

Currently, distance education programs for Chinese as a foreign or a second language are established in at least three Chinese universities. The three universities are:.Beijing Language and Culture University, Beijing, East China Normal University, Shanghai, and Nanjing University, Nanjing. Beijing Language and Culture University has an excellent database of Chinese Language material for teaching foreigners. East China Normal University is designing courseware for beginners to learn Chinese as a foreign or second language. Finally, Nanjing University began earlier research in methodology for designing distance courses for other disciplines. Each program has valuable design research to contribute. The experiments described in this paper are tasks developed for the early stages of the "Program of Multimedia and Networked Instruction of Chinese Language". This program is the property of the Institute for International Students at Nanjing University.

These programs are in response to the increasing demand for Chinese language study as international relations and world trade continues to rapidly grow. The need for culturally based instruction using the Internet and multimedia was recognized at Nanjing University and a pilot program was begun in July, 1998. It was the first program of Chinese as a foreign language using these technologies in China. The pilot project was begun between China and Japan. In Japan, most terminals were located in Naha City and in Akashi City.

The Initial Project

One major purpose of this project was to explore the methods of effective distance learning and instructional design. The initial phase began with an advanced Japanese Student familiar with both the Chinese language, computer operations on the Internet. In July of 1998, the design team began a tentative "Advance Writing Course" using only Email communication between Nanjing and Okinawa. This Japanese girl student said: "Before this course, writing Chinese on the keyboard was as difficult for me as writing with a pen. But now I'm not afraid using the keyboard. I have less stress and more confidence.The team was inspired by the significant progress of the student in writing in just two months and began scanning graphics and reading materials to enhance the instruction.

In the spring of 1999, the design team was successfully in creating a Listening Comprehension and Oral Communication Course. They were able to transmit audio courseware through Voice e-mail . Four tentative advanced courses were established, Writing, Reading, Listening Comprehension and Oral Composition. In conjunction with the above courses, a Comprehensive Exercise Database for learning Chinese started to be established.

The program continually used new developments to enhance the project on the Internet including better voice transmission and making better use of the World Wide Web, FTP, HTML, Au, Wav, Jpg, Tif for sound, graphics and text. But Mpeg is still unable to be transmitted because of the lack of adequate bandwidth in China. However this might be temporary technical limitation because of the government and authority of IT in China stated that there would be great improvement after 2000.

The first stage of this distance program used pilot projects for elementary, intermediate and advanced learners. In the area of course design, creative coursework was developed using gaming, simulation, as well as behavioral and communication theory. For the elementary level, games were implemented in order to familiarize the students with pronunciation, structure patterns and basic Chinese written characters. The use of gaming techniques offered students the opportunity to explore the language in a non- threatening, interesting, interactive environment. Through the gaming activities students began to develop their cognitive and language skills.

At the intermediate level, behavioral techniques were tested mainly. The development team designed methods modeled after B.F. Skinners behavioral research using his step-by-step and reinforcement methods. These methods were effective for the more motivated learners.. At the advanced level the simulation method were applied and the students were more successful and preferred methods that allowed them to draw on interpersonal and problem solving skills from their own experiences. And the instructional design tries to help the students deepen the communication strategies.

Gaming Methods

Communication is an interactive process. Games provide a form of interactive play for children as well as for adults. Furthermore, games and simulations are methods well suited for computer instruction. Instructional games employ various formats that include an instructional goal. In different games, learners follow prescribed rules striving to attain goals related to specific outcomes. During the nineties a series of instructional languages games for the elementary level were created by the author of this paper. Some of the games were redesigned for the computer. Two games were selected for pilot testing as potentially effective for assisting students in mastering specific language skills.

One of the games called “Chinese Character Puzzles” was designed as a computer game to help beginners form the concept of Chinese Character development and also assist them in remembering the characters using mnemonic techniques. Chinese characters are based on pictographs rather than phonics. Unlike English, which is based on the formation of sound patterns, Chinese characters graphically represent the words or concepts they communicate. For example, the Chinese character for man is written like a man walking. The written character resembles the figure of a man. The ancient character for sun was written as a circle with a dot in the center. It was gradually squared off changing its shape to an elongated rectangle with a hyphen in the center. It is often easy to recognize a character and guess at its meaning. After a short introduction, learners are asked to interact with the characters and select some basic characters one by one from a menu and then chose a meaning that most resembles the character. If they chose an incorrect response, they are given a clue consisting of the ancient pictograph and another chance to select a meaning for that character.

Another game for the elementary level called “Dragon Bones” was designed to teach basic sentence patterns. “Dragon Bones” is composed of 36 dice-like cubes coded in seven colors which display more than 200 key words and phrases. The computer courseware consists of 216 colored squares. It is possible to display and manipulate the key words and phrases. In each square there are one or two Chinese characters with pronunciation and English translation explanations. Approximately ten of the selected Chinese basic sentence patterns closely resemble English language structural patterns. The structure of the Chinese language is not conspicuously complex . In fact, it is simpler in many ways than Japanese and western languages. This design strategy was targeted for English speakers.

For example:

1. Wo kan dianying.

I see movie.

2. Ta kan dianying.

He sees movie.

3. Wo zuotian kan dianying.

We yesterday saw movie.

In Chinese "kan" is a verb that means "to see". In English there are many forms of the verb "to see" (see, saw, seen, sees, etc.) but there is only one form of "kan" used in Chinese for every tense, case, person and gender. The pronouns and nouns have the similar characteristics. To learn Chinese daily conversation is not as hard as western languages that have complicated morphological changes. Through games the beginners may learn this oriental language in a more interesting way.

A learner who is working in a computer company as a programmer said: "It is really interesting and a lot of fun to play with the language dice as tools for learning a foreign language. I think I could improve the original idea and design. The 250 words and the basic strategy could be used to make a genuine computer game along with simple plots.

Reinforcement Methods

In the middle of the 20th Century the Harvard psychologist B. F. Skinner's reinforcement theory "is the foundation of the development of programmed instruction. In a programmed instruction course the learning material is divided into very small and carefully arranged steps. One course might include thousands of steps. The learner responds to question (often fill in the blank) by selecting an answer from a series of multiple-choice answers and proceeding one step at a time. The questions are displayed in a linear format often on some type of teaching machine, or specially printed books. While answering the questions, you reason your way through the program instead of being told what to do. The programmed steps are designed to prevent mistakes before they happen, so such programs could be called errorless learning. When there is an error the learner can identify it immediately.

The backbone of programmed instruction is reinforcement theory. After finding the correct answer in a frame, the trainee receives immediate positive feedback. Psychologists call it reinforcement. The more reinforcement, the more the confidence of the student increases. The positive reinforcement builds links to positive achievement and shapes the learning outcomes. Skinner's methods were constrained by the lack of interacting teaching machines in his time. The developers of this program used his older psychological theory on a Pentium Personal with Windows 2000. This technology allowed immediate feedback. One of the purposes in such experiments is for getting an answer. Will the up-to-date computers be flexible and adaptable enough?

Along with the computer project using the programmed instruction method. The design group is now evaluating a new Chinese text-book SITUATIONAL CHINESE (Qiu, Zhipu, Kyoto, Japan, April, 2000) for its effectiveness using the programmed instruction method. The following steps are examples of the programmed mode used in Chapter 1 of the text. (The English translations are for those readers of this paper who do not speak Chinese. The English translations do not appear in the textbook .)

Step 31:

Zhe	shi	nide	huzhao	ma?
This	is	your	passport ?	

Shi a, ( ) shi wode huzhao. Yidian ye bucuo!.

Oh yes, this is my passport. That's right,

***Chinese "ma" makes interrogative sentence.

Step 32:

Zhe shi nide feijipiao ma?

This is your flight ticket?

Shi a, zhe shi wode ( ). Yidian ye bucuo!

Oh yes, this is my flight ticket. That's right!.

Step 33:

Zhe shi nide jiashi-zhizhao ma?

This is your driving-license ?

( ), zhe shi wode ( ). Yidian ye bucuo!

Oh yes, this is my driving license. That's right!

Step 34:

Zhe shi nide ( ) ma?

This is your ?

( ), zhe shi wode ( ), ( ) !

Oh yes, this is my , That's right!

The learners evaluated the programmed exercises above and the majority felt the method was effective and interesting. But some, especially adult trainees, felt that small and easy steps were boring and tedious. Some of the learners said: "Different sizes steps are needed by various ages and entering competencies of the learner and the steps should be interesting and fun." Now the author is experimenting with larger steps." Another option is to use a more complicated branching program that loops students through remedial or choice frames. This method may be more effective for larger step reinforcement. The computer is most likely the best teaching machine for B.F.Skinner's theories.

Simulation Methods

Simulation is another method applicable to distance language learning. Simulation allows students to generate their own responses in real life type situations. In contemporary language classrooms when the students confront a simulation using real life-situations they have to use their own life experience in order to incorporate personal knowledge and practical, authentic response skills. The dilemma now is to translate these scenarios into effective computer courseware with feedback. Some pilot studies have been conducted. The following are two examples of the types of simulations with possibilities for the distance language program.

At the advanced level, two students took on roles in a simulation: one of them an interpreter and tour guide, the other a TV commentator. The scenario in the simulation presents culturally based information as the background for the tour guide and appropriate information about mass communication for the commentator.

For the tour-guide, information was provided about Kurashiki, a beautiful, historical city in Japan. First the student prepared a series of oral descriptions in Chinese including the city's history, scenery, legends, art galleries and ancient architecture. These descriptions were sent one by one to the teacher, acting as a Chinese tourist, via voice-email. A number of inquires and questions were sent orally in Chinese from the teacher to the tour guide .A spontaneous conversation developed and was sent back and forth between Nanjing and Japan. One conversation on a specific topic may last off and on for many hours. The topics about Japanese culture involved topics such as climbing Mount Fuji, sight-seeing in Tokyo, the kimono, food, Kabuki, etc.

Situations for the future media commentator or newscaster involved announcing the news in Chinese and answering questions from voice-email. In this case, the teacher corrected the student's errors and provided more difficult and interesting material for further discussion. The student made a videotape in which she played a food expert talking and demonstrating the differences in cooking methods and flavors between Chinese and Japanese cold noodles. This thirteen-minute tape has been processed by the design team into VCD courseware as a case study.

The scenarios are accompanied by an oral Chinese textbook "What to Say and How to Say It" (Qiu, Zhipu, 1990, Kyoto, Japan). This text for students at the advanced Chinese level was designed to familiarize the readers with the proper use of expressions, not only in everyday situations but in more complex ones. It covers correct and appropriate ways to apologize, praise, complain, criticize, discuss art, religion, war, marriage and business negotiations. The scenarios may be open-ended situations, first showing how to interact and then offering a problem or conflict for the student to finish.

Conclusion

From July of 1998 until the end of 2000 about 250 experiments were pilot tested, most of them at the advanced level. But, as mentioned previously, instruction through the Internet, with games, simulations and programmed exercises and the use of the new technologies for language instruction is just beginning in China. For the most part, the pilot experiments conducted for this project were effective for self-motivated learners especially on the advanced levels. There are about 18 millions users of Internet in China . But, the Internet in China for popular use is still in its infancy. The constraints are with the communication capabilities and lack of bandwidth. First, In China, distance learning through the Internet is relatively expensive more than using radio and TV, audio tape and video. Because China is a developing country. But aside from the enrollment fees, the cost of using the Internet for learning in developed countries is minimal and able to provide authentic and real time experiences. Second, designing courseware and building databases is time consuming and tedious. It's a laborious and creative work. There is a need for innovative teachers and experienced software designers. On the initial market of software in China the software for learning is often substandard or at best mediocre and lacks the full range of authentic interaction. But there is no doubt that distance learning using the newer technologies is valuable for language instruction. We hope in the near future to develop more creative, interesting, and effective teaching and learning tools using the newer technologies now available.

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Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Invasion or Giving Up of Internet Privacy?: A Personal Divide Emerges

Jisuk Woo

Abstract

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I. Introduction

Computer and telecommunication technologies have generated great concerns regarding the protection of privacy on global networks. Many scholars, policy-makers, and netizens have discussed appropriate methods to protect privacy in e-transactions and to ensure protection of personal information on the networks. International organizations such as OECD have also been active in providing relevant principles. Recent development in Internet privacy is to suggest various government policies and industry codes of conduct, and respective responsibilities among governments, businesses, users, and international organizations have been a focus of the recent debates.

However, before we further discuss the role of the governments, businesses, international organizations, and users in ensuring the protection of privacy, understanding what it really means to have privacy in the networks would be necessary. The concept of privacy itself has been developed at a specific historical background, which surrounds the development of the printing press and its ability to make people's private matters public information. Therefore, the networks as a new communication environment may change the concept of privacy, regarding what values people find necessary to ensure their dignity and autonomy as human beings.

In a 1996 survey, 90% of the respondents answered that they are very or somewhat concerned about privacy concerns on the Internet. But it reality, it was found that they were willing to sacrifice privacy on the networks if they get some monetary rewards such as sample products or discount coupons by revealing their personal information. Still, concerns about privacy and security are ranked as one of the most serious factors that deter people from participating in electronic commerce. So what is really happening in people's minds regarding privacy on the networks?

The puzzle described above calls for exploring the implications that the new, networked environment has on people's privacy consciousness, before we begin to discuss appropriate approaches to restrict the invasion of privacy. This paper explores how the development of information technology, especially the interactive, networked computers, changes the privacy environment as experienced by individuals on the network. And it attempts to re-conceptualize the privacy issue when people tend to willingly give up their privacy for consumer convenience and other monetary benefits. The previous privacy concept that focused on the "invasion" of privacy will not work in this scenario. What is at work is not any longer an external entities such as the governments and commercial industries that "invade" the people's rights to be alone, but rather voluntary giving up of privacy and willing participation on the provision of personal information. This paper discusses how a new privacy concept could capture this new phenomenon and its cultural implication for people's autonomy and dignity on the Internet.

II. The Development of Information Technology and the Modern Concept of Privacy

The original concept of privacy started with the concept of "the right to be let alone" (Warren and Brandeis, 1890), as people's private matters were threatened to be publicized due to the development of the printing press and popular media. At that time, the privacy issue concerned the relationship between authoritative institutions such as the state or the press and a person. Thus the concept of privacy was based on the desire to be free from the surveillance of the external forces and from the consequent pressure to conform.

The basis of the modern state was to collect information about the members of the state for management and surveillance. With the computerized database, the ability to collect and manage information has greatly increased. This technological development not only helped the state or other authorities, but also enabled the commercial entities to utilize personal information of the consumers effectively. By the proliferation of the direct marketing, people were not only subject to one big brother's surveillance, but also to that of the thousands of computers that process consumer information.

When the computers are networked and become interactive, new ability for interactive communication began to raise another concern about privacy. Every communication leaves trace on the network. When a person surfs the web, information about all the websites he visited, when and where he visited, how long he stayed in each website, in which order he visited, etc. is reported back when the site server uses the software named cookie. And it is reported that more than 90% of all the websites use this technology. It means that every activity on the Internet is being reported and transformed to data somewhere, and profiled.

Many critical scholars noted this phenomenon as one of the most difficult but often invisible problems in information society, bringing such concepts as a surveillance society or a panopticon (see Gandy, 1993; Lyon and Zureik, 1996; Agre and Rotenberg, 1997; Decew, 1997). These scholars have pointed out that the cookie software and all other methods of obtaining personal information from service providers make the Internet an environment with less anonymity and autonomy for the users. But the criticism in this regard so far seems to focus on the matter of the degree or the subjects of surveillance, rather than attempting to identify if there has been any fundamental changes in the expectation of privacy in the networked environment. It is true that the surveillance on individuals is not only conducted by the big brother, i.e., the government or the state as was the case when the concept of privacy first emerged, but also by hundreds and thousands of computers operated and accessed by numerous commercial bodies. And it is also true that the degree of surveillance has even increased in the networked environment due to many new abilities of the new technologies. These arguments and observations take a note of an important new aspect of the Internet regarding privacy, but they are still based on the old concept of privacy, which is to protect oneself from some external power. An unfortunate result is to focus on policy measures that could be "done" by external entities such as governments or businesses "for" individuals, without considering that probably a fundamentally new philosophical positioning or moral basis might be needed to achieve a level and shape of privacy that people in the networked environment would find comfortable.

III. Individual Privacy and Autonomy in the New Environment: Is There Really a Problem?

It has been suggested that although the Internet has often been praised as anonymous space, with the cookie software and all other methods of obtaining personal information from service providers, it certainly turns out to be untrue. Then if an important basis of privacy is anonymity, how can you ensure anonymity on the Internet? Concealing your identity on the Internet can be achieved by providing incorrect registration information or using false identity on the Internet. Many people do conceal their identity, and there is even a book about how to trick your identity on the Internet. So in this new environment, to have a right to protect oneself from revealing his personal information should be assisted by a right to lie. But will this right to lie be acknowledged by society even if there is need for this to ensure the same level of privacy on the Internet as in the real space? The answer depends on to whom you ask, but those with authorities and commercial power tend to say no, at present. The Internet service providers require correct registration information, and if it turns out that the registrant provided false information or identity, he is at disadvantage when damages or disputes occur. The primary apparent reason for monitoring the Internet users is to prohibit infringement of intellectual property rights or to prevent cyber crimes. Even some software products contain secret links in them that enable them to be linked to the servers and pass along a variety of information regarding when the consumers use the software, where and how long, etc., often without a clue to the user. It is also possible that the manufacturer could command and control the software or even remotely disable the software if it seems to be working on the "wrong machine." The consumer anonymity is completely compromised, in the name of often-cited justification of piracy-control.

In conclusion, individual privacy is less protected on the Internet than in real space. For example, in real space people usually have a right not to be listed on the telephone directory, but on the Internet, not even that amount of anonymity is not allowed unless people are given a right to actively lie. So the question is, are we ready and willing to allow this right to lie for the sake of a right to privacy? In this new networked environment, it seems that we cannot have one without the other. Thus, it would be futile to discuss technical and social methods to achieve privacy when we have not decided whether we are ready to change our fundamental moral concept to achieve it, because it is one thing to claim that privacy is an important right but it is another thing to actually sacrifice other important values for it.

Then let us think about how the individuals are actually influenced by this environment. Are they taking it as a problem? What happens to the individuals when these technologies capture personal information? The individuals would get advertising messages and coupons probably through e-mail. Or sometimes intelligence software automatically provides personalized entry of their favorite sites, such as Amazon.com. Thus, many people find this profiling with the help of cookie technology actually very useful. As the Internet is now a sea of information where too much information can be a problem, providing specially selected useful and relevant information to the individuals and presenting customized site entry are rather acknowledged with gratitude. Thus although people may say that they are concerned about Internet privacy, they willingly give up their privacy for consumer convenience and other monetary benefits.

This situation calls for an effort to re-conceptualize the privacy issue because the previous privacy concept that focused on the issue of the "invasion" of privacy will not work in this scenario. What is at work is not any longer external entities such as the governments and commercial industries that "invade" the people's rights to be alone, but rather voluntary giving up of privacy and willing participation on the provision of personal information. Without fully exploring a new concept that could capture this new phenomenon and what it means to people's autonomy and dignity on the Internet, exploring methods to achieve the traditional notion of privacy that was developed in the printing era would turn out to be missing the point in this new environment.

IV. New Challenge: Personal Divide and Its Cultural Implications

If not "invasion" of personal space from external forces, then what would be a really significant implication of the new information environment? In my view, it relates to the fact that people are more and more relying on the information that is prepared by other people, or even computer intelligence. Their decision making process is no longer based on the incidents they directly experienced or the information they actually searched for themselves. Hence comes a need to seriously question whether there would be a difference in a way of life between a person who understands this mechanism and a person who does not. A degree to which a person has autonomy regarding the control of information about himself and regarding the relation to outside information influences the establishment of the person's identity. There have been many debates about the digital divide, which refers to the phenomena that the development of computer technology increases rather than decreases the gap between the information haves and have-nots. But what we are facing here is not just related to the traditional categories such as the class, occupation, education, etc. Those with quite similar educational level or experiences in their area of expertise may be in quite different positions from each other regarding how aware we are about this privacy issues. Thus the degree to which we can consciously prepare our interaction with our own and external information would amount to very personal and individual differences. And this personal divide among those within apparently similar social situations could be even more powerful and invisible one than the digital divide.

The individual difference in privacy consciousness may have existed long before the introduction of computers and other new information technologies, but the quickly changing information environment seems to broaden rather than reduce this difference. Also, as the development of information technologies provides new and more easier ways to use personal information, efforts to control the flow of personal information with laws and regulations would be supplemented by more contract-based approaches that provide individuals option to choose whether or not to release one's personal information. And this option would result in broadening the personal divide regarding privacy concerns even further.

The concept of a personal divide regarding privacy consciousness in the networked environment is in its infancy, and more discussion and research should be done to better understand its implication. But one thing that we can be sure is the fact that the new concept or the new phenomenon would have a double edge for privacy concerns. A personal difference may suggest a possibility of overcoming traditional boundaries and limitations such as class and education, which have been considered important categories when privacy issues as well as more general social issues in a networked environment such as a digital divide are discussed. It may relate to a hope that even those with less formal education and lower class background could achieve high privacy consciousness if personal involvement and specific privacy-education are combined. But at the same time, a personal difference, as it is often invisible, may make it even more difficult to capture what the real issue and problem is. Further, even after a problem or an issue is identified, if the problem is considered a personal difference, it becomes very difficult problem to be tackled with due to the lack of an organized effort to solve it.

In that negative regard, the most important implication of this personal divide concerns cultural differences. As with many other information-related "rights", privacy is a concept that is developed in Western thoughts and traditions. Asian countries tend to be more community-focused and thus be less conscious about protecting individual privacy within the community. With regard to "information" privacy and a "right" to one's own information, there is even more difference. As an example, many Korean elementary and high schools publicly post exam scores of the students publicly, and sometimes students are seated according to their scores. And many Koreans find it not easy to ask for their own medical records to their doctors. This difficulty may be because people tend to worry about hurting the doctors' feelings, but it also relates to the fact that Koreans tend not to think they have any "right" to information about themselves. It is not difficult to imagine that these people would be more willing to concede to the release and use of their personal information for monetary benefits or convenience in everyday life. The development of information technology is also an imported one for many less developed countries. Different from Western developed countries where information technology has been relatively slowly developed and adopted throughout the society, less developed countries have faced very fast, sudden importation of various information technologies without having enough time to measure their effects on their societies. Therefore, people in many Asian countries with less developed economic situation and qualitatively different cultural background would have very confused reaction to the ability of these new technologies that make constant use of personal information possible.

As a result, privacy advocacy is relatively weak in Asian countries, and one's own information is more easily provided for economic benefits, for obvious reasons. More importantly, people tend not to think of giving out one's information as something with a serious consequence. Contrary to the hot debates and strongly opposing arguments surrounding the introduction of Caller-ID services in the United States, a recent hearing about the introduction of the same services in Korea ended with very little discussion about its possible negative effects on individual privacy. In this situation, the personal divide regarding privacy concerns would end up giving very specific disadvantage to those with certain cultural background. This seems to be a really serious problem because although, for example, Asians may have less experience or concerns about the commercial use of personal information due to their cultural and informational background, they are living in the very same kind of environment because of the global nature of the networked society.

V. Conclusion

This paper discusses the ways in which a new personal divide emerges regarding privacy consciousness and relevant activities, especially among those with seemingly similar educational and financial backgrounds. Understanding cultural aspects of this personal divide is critical in conceptualising the concept of privacy in the networked environment. The ways in which we interact with the information environment are changing. The development of telecommunications technology and its convergence with computer technology generate great changes in the ways in which information can be collected and managed. The question is, will this increase in the capacity related to the processing of information amount to some kind of qualitative change? Or is it only a matter of degree, of the processes that have always been there? Could the Internet surveillance techniques and subsequent changes in the ways we interact be considered a kind of "paradigm shift"? A paradigm shift enough to justify different "goals" to achieve now, rather than only different methods to achieve the same goals as before? These questions are very difficult to be answered, but they are the ones that could provide the most important basis for setting policy parameters. Through more systematic studies on the changes in the information environment and what they mean to people's lives and experiences, we will be able to decide whether we need a new conceptualisation of privacy as a changed social condition, and how we could proceed with policy-making endeavors. Only with the appropriate conceptualisation of what privacy means in the new information environment, will we be able to discuss how to support those with lower privacy consciousness and to approach the greater issue of privacy that seems to have significant financial, social, and human consequences in the future.

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Back to top of page Back to the sessions page

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Back to proceeding page **Back to the sessions page**

An Experiment of Cultural Heritage Presentation System

Nobuyoshi Terashima, **John Tiffin**, **Lalita Rajasingham**, and **Anne Gooley**

Abstract

http://www.giti.waseda.ac.jp/GITI/staff/pr-nt

Introduction

In accordance with the advancement of information technology, tele-education and on-line collaborations have emerged. However in these activities, a number of problems have been pointed out ;such as time difference, language barriers and differences of cultural backgrounds.

Time difference will be avoided by using avatars or computer agents. Language barriers will be overcome by adopting translation technology. The most important issue is how to have mutual understanding beyond different cultural backgrounds. To achieve this, Waseda University of Japan, Victoria University of Wellington of New Zealand, Global Virtual University of New Zealand and Queensland Open Learning Network of Australia are now conducting a joint research and experiment on how to develop a platform on which cultural exchange can be carried out. We call the platform the cultural heritage presentation system.

In this research, we have developed a system which runs on the Internet, whereby participants at different locations, in reality their avatars, and any 3D objects of cultural heritage are brought together through communication networks to communicate, handle the object by using hand gestures and examine the objects stereoscopically by wearing shutter glasses. After developing the system, we have conducted a series of experiment by interconnecting Waseda University, Victoria University and Open Learning Network via the Internet. The purpose was to introduce 3D objects of Japanese artifacts ,handle them at each site and examine from all angles. In the experiment, a Japanese teacher whose avatar appears in the system explained about Japanese culture by showing the 3D objects and discussed them via the system with students in New Zealand and Australia, in reality their avatars. The experiment was successful in proving that the system facilitates understanding of different cultures. In this paper, the system concept, the technologies which have been developed and used and the experimental results are described.

System Concept

The system has been developed for the cultural heritage presentation, whereby participants at different locations, in reality their avatars, and any 3D objects of cultural heritage are brought together via the Internet and they can communicate, handle the object by using hand gestures and examine it stereoscopically by wearing the shutter glasses. Fig.1 shows the system image. In this figure, two avatars are shown. One is a teacher and the other is a student. In front of them, a 3D object is shown.

They are going to handle it by hand gestures. The avatar's motion is controlled by a real human motion. In the background, a picture of the students who attend at remote place is shown to see who attend there.

The system is based on HyperReality. HyperReality is a concept of merging physical reality and virtual reality through telecommunications. HyperReality introduces the concepts of HyperWorld and coaction fields. HyperWorld is a seamless world of the real and the virtual with one or more coaction fields .A coaction field is a 3D space where inhabitants, human beings or animals, real or virtual, at different locations, are brought together via communication networks, to work or play together as if they were gathered at the same place. One of the applications is HyperArtMuseum. Each people is at a different location. Through HyperReality, people at different locations are brought in to a HyperArtMuseum on the networks and able to enter the museum, walk through it. enjoy looking at the artistic products and listen to a guide that may be a computer agent.

Fig.2 shows HyperArtMuseum.

Three people are brought together via the Internet into the museum. They enjoy looking at the masterpieces of painting. The lady sitting on the bench may be a computer agent and she is explaining the painting.

Fig.1 System Image

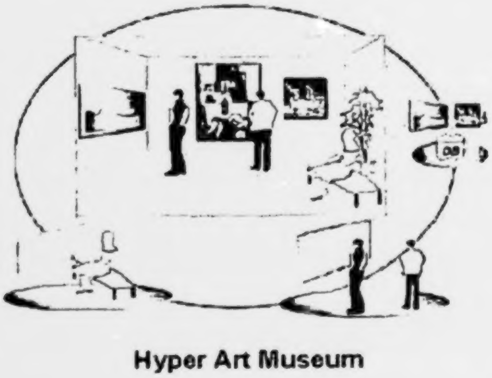

Fig.2 HyperArtMuseum

Technology

To realize the system, the following technologies have been developed.

(1) Stereoscopic view through multiple pictures

A new method for stereoscopic view has been developed. The pictures of the object are taken by camera from every 30 or less degrees around the object. When viewing, one of the pictures ,which is appropriate, is chosen according to the viewer's position and displayed stereoscopically. This method is useful for the object which is a big one and hardly measured by a 3D scanner. Fig.3 shows the image of this method.

When the viewer is in position A, picture a is displayed. When she/he is in position B, a picture b is displayed.

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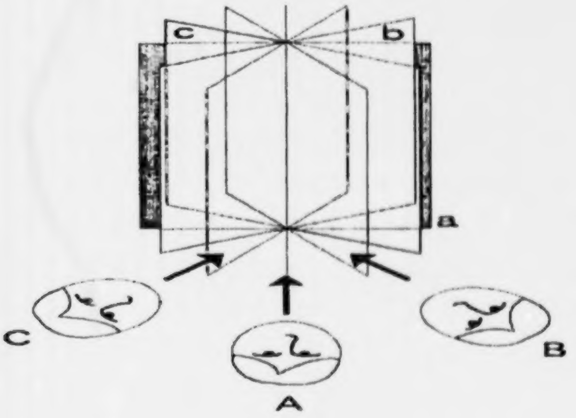


Fig.3 Stereoscopic View of Multiple Pictures

(2) Detection of human face direction

A high speed human face direction detection method has been developed. The algorithm is as follows. More than twenty samples of the human faces are taken by camera from various angles. The edges of the face, mouth, nose and eyes are detected and stored as the templates of the facial contours. When a human face is taken by camera, the facial contour is detected, compared with the templates, the distance between the input facial contour and each of the templates is calculated and the best fit template is chosen with the shortest distance. An experiment using twenty one templates showed a good result. According to the experiment, the direction of a human face in the range of +-90 degrees in horizontal and +-30 degrees in vertical could be measured with the error range of +- 2 degrees in horizontal and +-3 degrees in vertical.

(3) Cooperative work

To realize a cooperative work, a method has been developed, whereby a 3D object is moved or rotated by a composite force given by two people. A fraction of the movement of the object caused by an operator is translated to an element force vector at each side and the consequent movement of the object is determined by the composite force vector which is calculated by summing up all of the element force vector applied to the object.

Fig.4 shows the image of the cooperative work. The element force vectors a and b are translated into a composite force vector c.

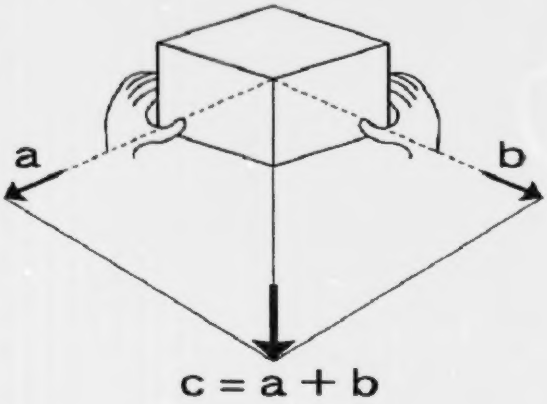


Fig.4 Composite Force Vector

(4) Intelligent coding

An intelligent coding is used to reduce the amount of data transmitted via the Internet. The coding method enables the use of Internet for the operations of the system in real time. In the system, the human image data and the 3D object data are transmitted via the Internet before the session to each side. During the session, only the human motion or the object motion is transmitted from a client to every other clients via the server in the event driven manner. The human or object image which is stored at each side is restored and deformed according to the movement information and displayed on the screen.

In order to input the 3D image of cultural heritage, 3D cyberwares have been introduced. The scene of a 3D cyberware is shown in Fig.5. On the plate, the object is set and then the shape of the object is measured and the color texture is acquired, The information is stored in the system. When it is used, the information is retrieved. Using the information the 3D image of the object is reconstructed and displayed in the system stereoscopically. When it is handled by hand gesture, the movement information of the object is detected and transmitted to each site. Using the information, the object is deformed and the texture is mapped and displayed in the system in real time.

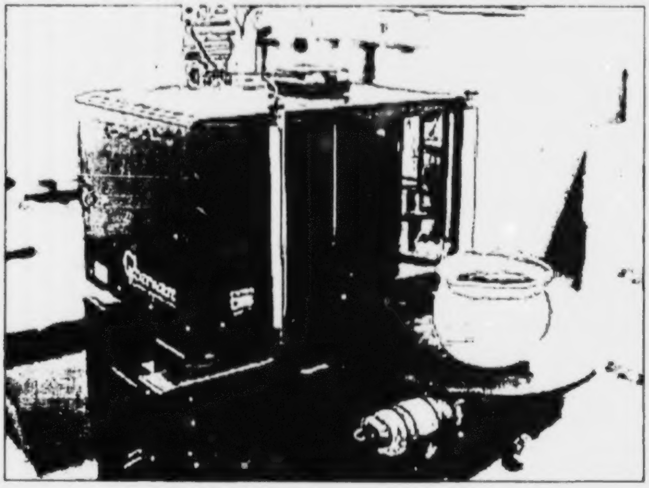


Fig.5 The Scene of a 3D Cyberware

Fig.6 shows some of the 3D objects input by 3D cyberware.

Each object is an ancient Japanese decoration pot produced in ancient times.

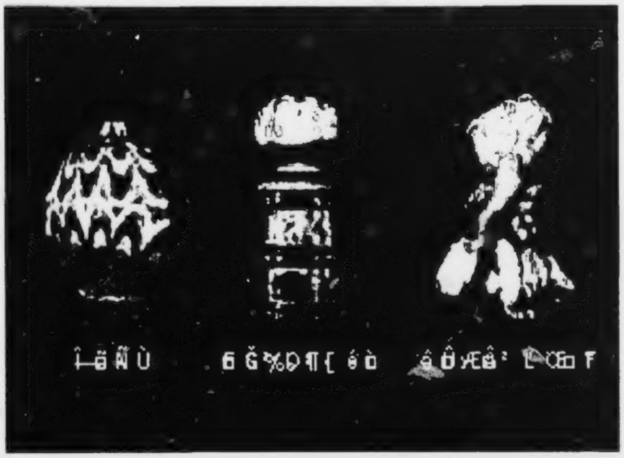


Fig.6 Examples of Japanese Cultural heritage

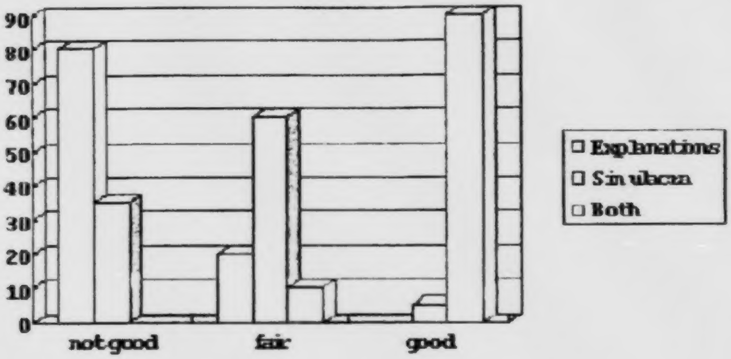
Experiment

After developing the system, we have conducted a series of experiment by interconnecting Waseda University, Victoria University and Open Learning Network via the Internet. Fig.7 shows the experimental system for cultural heritage presentation. The purpose was to introduce 3D objects of Japanese artifacts ,handle them at each site and examine from all angles. In the experiment, a Japanese teacher whose avatar appears in the system explained about Japanese culture by showing the 3D objects and discussed them via the system with students in New Zealand and Australia, in reality their avatars. On the other hand a student could grasp the object by hand gesture and look it around from all angles. The scene is shown in Fig.8. In order to evaluate the effect of the system, an experiment was done in the following three cases.

Case 1 is that only explanations are used to understand Japanese artifacts.
Case 2 is that only simulacra are used to understand them.
Case 3 is that both explanations and simulacra are used to understand them.

Each student scored 'good', 'fair' or 'not good' for each case. Table 1 shows the result of the interviews. According to Table 1,80% of students scored 'not good' for case1 and 20% of them scored 'fair'. 35% of students scored 'not good' for case2 ,60% of them scored 'fair' and 5% of them scored 'good'. 10% of students scored 'fair' for case3 and 90% of them scored 'good'. Finally case3 is most appropriate for understanding different cultures. The result showed that they could understand Japanese culture by not only their explanations but also watching and handling the simulacrum actually. Then this system proved to be effective because the system provides both of the facilities. The experiment was successful in proving that the system facilitates understanding of different cultures.

Table 1 Opinion Test (%)



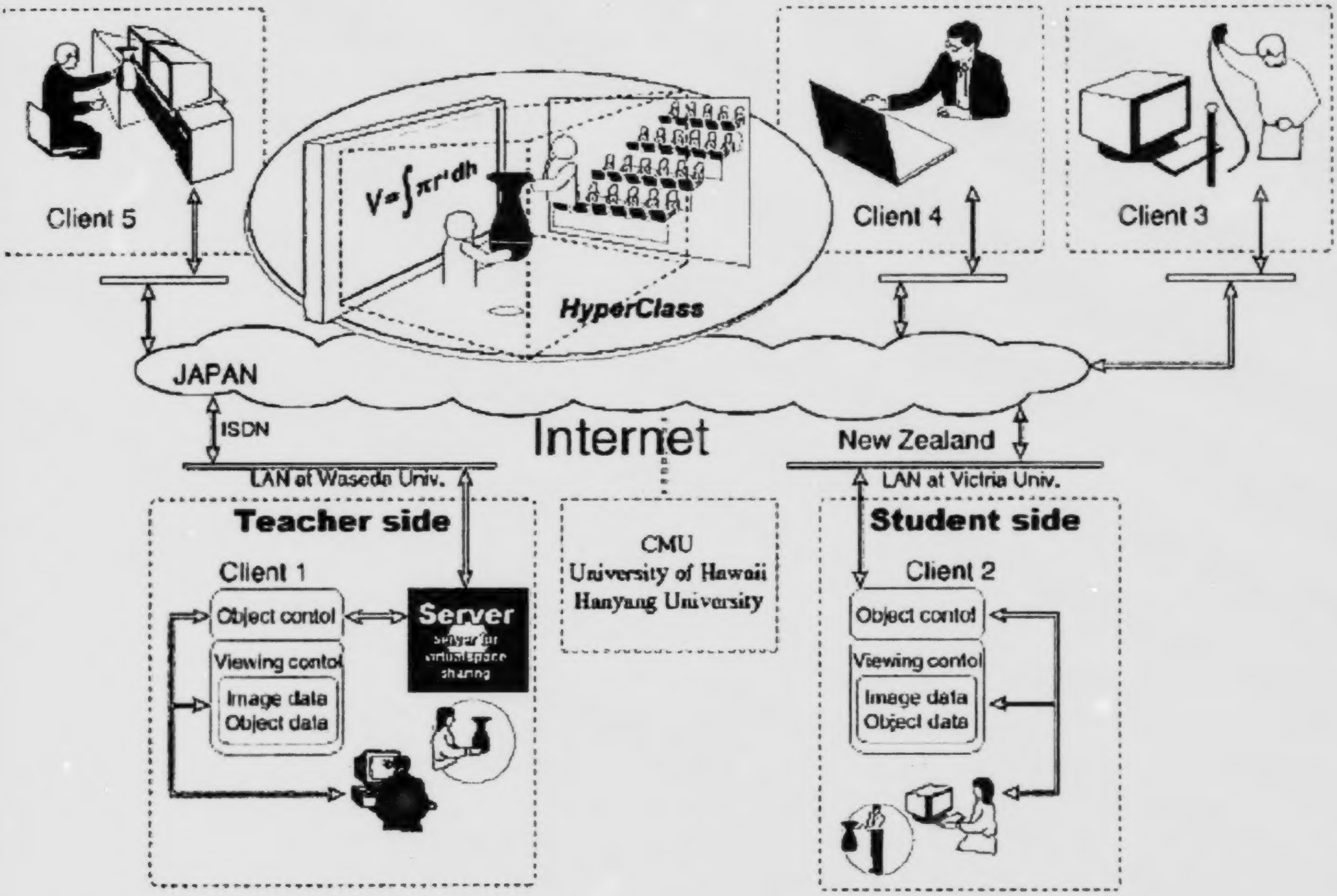

Client 5
V=∫πr²dh
HyperClass
Client 4
Client 3
JAPAN
ISDN
Internet
New Zealand
LAN at Waseda Univ.
LAN at Victria Univ.
Teacher side
Client 1
Object contol
Viewing contol
Image data
Object data
Server
server for virtualspace sharing
CMU
University of Hawaii
Hanyang University
Student side
Client 2
Object contol
Viewing contol
Image data
Object data

Fig.7 Experimental System

BEST COPY AVAILABLE

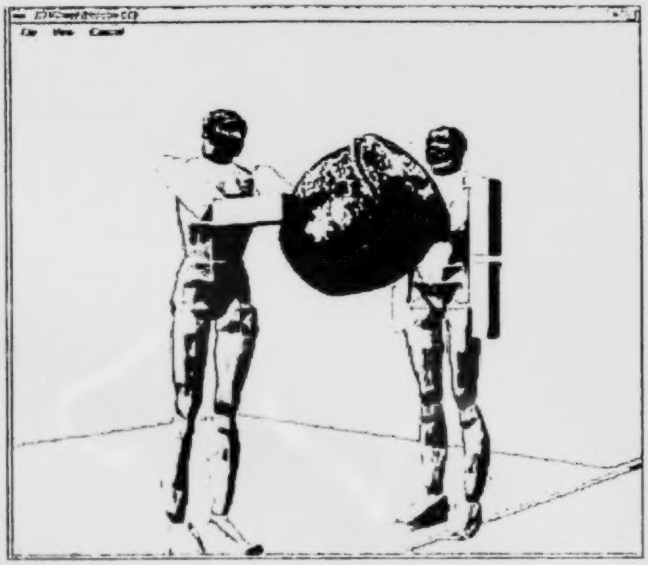


Fig.8 Scene of Object Handling

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Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Program

Country / Region

Wednesday, 17 January 2001
0830–1000

W.1.3 East Asia

Location: South Pacific I

Chair: JOHN SPENCE, John A. Spence & Associates, *Australia*

W.1.3.1 From Expectation to Emergence: Telemedicine in China (ABSTRACT)

LIANGYI CUI, Associate Professor, and KAISU ZHUANG, Student, Shanghai Jiaotong University, *People's Republic of China*

W.1.3.2 The Growing Demand for Flexible Outsourcing Solutions for the Emerging SME Market in Japan

SIMON KRIEGER, Executive Vice President, Service Development, Vectant, Inc., *USA*

W.1.3.3 Designing and Planning of National Optical Network in China (ABSTRACT)

RAYMOND H.M. LEUNG, Senior Advisor; Q.L. DING, Senior Engineer; and VINCENT W. HUNG, Engineer, One Trend Net Ltd, Hong Kong, *China*

W.1.3.4 Evaluating the Market for Internet, Access Services and E-Commerce in South Korea (ABSTRACT)

SIMON BUREAU, Managing Director, Vectis International Inc., *Canada*

From Expectation to Emergence: Telemedicine in China

Liangyi Cui and Kaisu Zhuang

Abstract

http://www.sjtu.edu.cn

The 5-year history of telemedicine in China has produced some agreement on its significance and potentials. The following ideas are among this consensus:

- Telemedicine helps to accomplish the goal of "Medical Care for Everyone by the Year 2000" in China.
- The policy of "Constructing and Operating Hand in Hand" is adopted in telemedicine here.
- Implications of telemedicine involve technological, medical, economical, psychological and cultural dimensions.

1. Introduction to Telemedicine in China

This half decade has seen the rapid development of telemedicine in China since the well-known case of Ms Zhu Ling. It was in April, 1995 when a few young students from Beijing University sent an SOS E-mail through Internet appealing for international help for a young girl student called Zhu Ling, who was dying of a severe but unknown disease. The message was widely spread through news groups and mailing lists on Internet. Since then they had received over 2,000 E-mail replies from 18 countries and regions. A list of 84 persons who made the correct diagnosis by themselves or by their friends showed how Internet played a vital role in saving Ms Zhu's life. This case instantly brought telemedicine to people's attention in China. As Dr. Hamilton pointed out, "It may be that Zhu Ling's illness has helped change the way medicine will be practiced---with more resources available the world over." Now, a national internetwork architecture has been implemented, which uses public and ubiquitous networks and tools to address the issues of communication bandwidth, availability, image quality, and security. Telemedicine tends to become part of the daily life in big cities of China.

2. The Spectrum of Telemedicine in China

- Online Appointments With Experienced Doctors

National telemedicine systems connect with hospitals and clinics, large or small, in China. For example, *China's Hospital Information Net* (www.chin.ac.cn) hyperlinks hospitals nationwide. It is fast and easy to access information of any particular hospital through it, or indirectly by a search engine of a portal Website of China. Alternatively, local telemedicine systems hyperlink key hospitals in a big city or in a certain region. For example, *"At Your Medical Service"* of *China's Economical Information Net* (serve.cei.gov.cn) lists all key hospitals in Beijing, including Beijing Hospital, Beijing Maternity Hospital, the 3rd Clinical Hospital attached to Beijing University, Beijing Tongren Hospital, Beijing TCM Hospital, Beijing Children's Hospital, People's Hospital, Union Hospital, General Hospital of Air Force of PLA, and so on; *China Rehabilitation City* (www.rehabcity.net.cn) lists 64 key hospitals and more than 1500 famous doctors. People can make appointments with doctors they prefer from home or anywhere through emails, live "chatting" or board messages.

- Online Advice From Doctors

The advantage of remote consultations with multiple expert doctors seems obvious although its practical implementation in China is relatively limited by the cost, availability, image distortion, and security of telemedicine systems. Traditional online consultation is as simple as a patient telephoning a doctor for advice or counsel, arranged by certain radio programme, which proves helpful especially for unusual or rare diseases. In a more advanced form, telemedicine brings expert doctors situated thousands of miles afar into a virtual examination room via a live interactive telemedicine system. However, people could afford it only in emergency, or in rare and difficult cases. At present, telemedicine remains in its infancy stage in China. With its development, more patients will get their suitable treatment before it is too late.

- Online Medical Test Reports

As was revealed by an investigation on Beijing Children's Hospital, among its 3000 patients per day, those who needed medical testing occupied less than a quarter (about 700). Most of them could not read the test report on site. Usually, they had to return to the hospital in another day to take it. *Health 123* (www.jk123.com) is the first Website in China to publish medical test reports online authorized by a number of hospitals equipped with HISs. It has been aware of security of privacy and other legal issues. At present the patient can only access to his (or her) own test report with the correct password.

- Online Health Science Education

Currently, this is a blooming area due to the actual increase of living standards here. Large amount of health and medical knowledge as well as medical news are available on various Websites, which offer Internet services such as E-mail, FTP, WWW, BBS and telnet. These Websites are dedicated to the free flow of information in support of medical education and patient care. They greatly promote communications between health/medical workers and ordinary people. Hot topics of nowadays are bantingism, cosmetology, nutriology, nourishing, body-building, sport, ..., mental health, the list is endless.

- Online Forums for Patients

A well-known Chinese proverb says: "Fellow suffers commiserate with each other". Now it has got a new sense: fellow suffers communicate with each other. As a matter of fact, telemedicine has attracted them together by establishing a number of virtual medical forums. Many patients like to get online consolations and suggestions from those who suffer similar disease as well as advice and counsel of professional doctors. Some cancer patients suffer more from the mental pressure of the shadow of death than from the symptoms. Online forums bring them love, hope and esprit besides the medical treatment by doctors.

It is the charm of telemedicine that the best medical resources can be accessed by a remote site anywhere in this country or in the world through Internet.

3. *Shanghai InfoPort* Applied to Telemedicine

The key centers of telemedicine in big cities such as Beijing, Shanghai and Guangzhou are connected with numerous hospitals, clinics, ongoing research, and training projects through Internet. They play a core role in telemedicine of China. A case study of Shanghai is as follows.

Shanghai is expected to become, by 2010, one of international economical, financial and trading centers in the world. To achieve this goal, Shanghai began to build her municipal information infrastructure called *Shanghai InfoPort* (short for *Shanghai Information Port*), which implies the huge throughput of information.

As part of *Shanghai InfoPort* plan, *Shanghai Education and Scientific Research Network (SHERNet)* was designed in April, 1995 and fulfilled in April 1996, which symbolized the initial success of *Shanghai InfoPort*. It was equipped with CONVEX-C240 supercomputers, SUB-SPARC20 stations, and CISCO-2511 and CISCO-4500 route switches. Intel ProShare and SGI stations were used for its distance learning systems and telemedicine systems.

The constructed trunk line of *SHERNet* included ten nodes: Shanghai Jiaotong University (the key node), Fudan University, Shanghai Medical University (now merged into Fudan University), Shanghai 2nd Medical University, Tongi University, East China Normal University, East China University of Science and Technology, Shanghai University, and two offices of Shanghai Municipal Education Bureau. Donghua University (former China Textile University) was also connected to *SHERNet* through X.25 special line. On the formal opening ceremony of *SHERNet*, a famous surgeon named Yon Jinyuan (also a member of Chinese Academy of Engineering) demonstrated online examination of a patient who had just undergone an arm operation.

In December 1995, the Telemedicine System of Shanghai Medical University (now merged into Fudan University), one of the nodes of *SHERNet*, was established, which was the first real-time telemedicine system in the mainland of China. It was built in two-level structure with its core part supported by *SHERNet* to posses a 64k~2Mbps channel. It consisted of 8 consultation management centers as well as a number of specialized consultation centers such as for hand surgery, tumor pathological slicing, live cancer treatment and diagnosis based on medical imaging and so on. This telemedicine system adopted Intel's advanced technology, transmitting the compressed data and image information through *SHERNet*, telephone lines, microwave, and satellites to the remote areas. It successfully performed functions such as remote image transmission (static or dynamic), access to *Shanghai Guide to Medicine Database*, whiteboard sharing, online medical education, online registration, and other services.

Again in April 1996, another node of the backbone of *SHERNet, Shanghai 2nd Medical University Network (SSMUNet)* was put into practice. *SSMUNet* adopted the star topology as its principal part. The backbone was 100Mbps switchable fast ethernet. The major node of the *SSMUNet* used CISCO CATALYST 5000 switcher as data exchange center. It also took CISCO 2100/2800 switches as the major node switchers.

Medical universities and their affiliated hospitals have played an important part in telemedicine in Shanghai. As the demand surge, more commercial ISPs are also turning to hosting services of telemedicine. Among them, *Shanghai Online* is one of the prominent.

Currently, the successful expansion of *Shanghai Telecom Broadband Network* as a core project of *Shanghai InforPort* marks the significant progress in deploying the world's most advanced IT technology. It appears as the largest backbone of ATM Metropolitan Area Network (MAN). The network connects 8 core nodes over 622 Mbps links and 90 rim nodes over 155Mbps links. *Shanghai Medical Security Network (SMSN)* has applied it as its information platform, which is to be linked with more than 530 hospitals in Shanghai by May, 2001. In a word, *Shanghai InfoPort* is providing still better services, including LAN-interconnect, video-on-demand, IP-telephony, Internet access, email and video broadcast for telemedicine.

4. Implications of Telemedicine

The rapidly expanding telemedicine has and will have many implications for technology, economics, law, psychology and culture, in particular or in general. This paper highlights only a few of more important implications. The aim is to raise topics that deserve attention in the context of a surely proliferation of telemedicine systems in the years to come. These topics will become increasingly important in the future.

- Technological Impact

The development of IT technology will affect telemedicine and provide a still new spectrum of telemedicine systems and services. Specific focused developments will occur against general progress in IT technology --- increased medical databases, new types of user-friendly interfaces, enhanced Web search engines and etc. The relatively economic price of future IT products will provide a route into telemedicine for hundreds of thousands of home computer users.

- Economical and Social Benefits

Websites involving telemedicine have sprung up like mushrooms after rain. Several of them become very popular, such as *Health 123* (www.jk123.com), *Longtime Health* (www.healthoo.com), *Health on Capital-Online* (health.263.net), *Health on NetEase* (www.163.com/health) *Ceda MedOnline* (www.medonline.com.cn), *Chinese Medical* (www.chinah.com), *Three 9's Health* (www.999.com.cn), *Hot Life* (www.hotlife.com.cn), *China's Golden Health* (www.2919.net), and *China's Economic Information Net* (www.rehabcity.net.cn). It is rewarding for a Website to be part of telemedicine in its infancy and make it develop into a medical wonder. In the long term, its economical and social benefits could not be overestimated.

- Legal Issues

Telemedicine is a new thing. People find that their familiar traditions do not always apply in this new world. With it one might run into problems such as unauthorized use or release of private information stored in the telemedicine database, erroneous medical diagnosis, or inadequate advice provided .... There are already some new laws and regulations in this field. More laws and regulations on telemedicine are to be made with its fast proliferation and popularization.

- Psychological Dimension

Many people have not a full understanding of telemedicine and are challenged by the technology associated with it. On the one hand, it just takes some lesson or time to get familiar with operations on the home PC for telemedicine. On the other hand, people may feel that it "dehumanise" them in various ways. For example, who is liable when telemedicine is involved in medical diagnosis, or who is responsible if a telemedicine system gives bad advice — the doctor, the webmaster, or the system itself? Generally speaking, people still prefer to go to hospitals if it is necessary although they do not refuse telemedicine at the same time.

- Combination of Traditional Chinese Medicine and Western Medicine

As can be seen, among the many telemedicine Websites, there are some involving Traditional Chinese Medicine (TCM), such as *Chinese Academy of TCN* (www.cintcm.ac.cn), *Beijing University of TCM* (www.bjucmp.edu.cn), *Shanghai University of TCM* (www.shutcm. edu.cn), *Guangzhou University of TCM* (www.gzhtcm.edu.cn), *Yahoo (China)* (cn.yahoo.com/ Health/Traditional_Medicine). A wealth of TCM information is now available online, for instance, TCM literatures on health keeping & rehabilitation, orthopedics & traumatology, pharmacology, and phamaceutical technology of Chinese materia medica. Recent years have seen fruitful researches on medical-data related aspects such as medical terminology and vocabulary, acquisition, capture, entry, protection, analysis, extraction and mining of medical data, bilingual database design, bilingual representation and thesaurus tools. The TCM information, as tough as subtle, will no longer be confined within a single country but set free to flow through Internet. Gradually and inevitably, the advancement of telemedicine will crush the multilingual and cultural barriers between TCM and Western Medicine. Their combination will certainly provide more effective medical care to the mankind, especially in an effort to conquer diseases in which neither could succeed alone.

The above has briefly profiled some obvious implications of telemedicine here in China, which is rapidly developing in both its research and operational aspects. It has many implications. Some of them are akin to those of increased Internet services in general, whereas others relates specifically to the growing spectrum of telemedicine. It will be found that these topics will lead to other questions, many of which are overlapping and not easy to solve. But it is widely accepted in China that telemedicine is benefiting and will benefit people in the society. Telemedicine and Medical Reform in China have been regarded as two big events from the end of 20th century to the beginning of the 21st century.

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Back to top of page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

The Growing Demand for Flexible Outsourcing Solutions for the Emerging SME Market in Japan

Simon Krieger

www.vectant.com

Good morning ladies and gentlemen.

I'll be speaking today about the increasing importance that outsourced technology solutions will play in the e-commerce initiatives of Japanese businesses - in particular, those of small and medium-sized enterprises. The emerging interdependence between the suppliers of these solutions and the companies that utilize them will permanently transform the way business is transacted in Japan.

To economize on words, I'll use the accepted industry term ASP, or application service provider, when referring to the organizations that design and deploy these solutions.

According to a tracking study by Zeus Research examining ASP usage by American companies,

- 62% of the companies surveyed implemented from 2 to 6 ASP applications in the third quarter of 2000, compared to 58% in the second quarter. In addition,
- 31% of the companies surveyed reported that more than half of their computing devices were accessing ASP applications in the third quarter of 2000, up from 25% in the second quarter.

The trend of American companies farming out specific technology needs to ASPs is only a few years old, but as can be seen in the Zeus Research findings, it is rapidly gaining in popularity. Applications that companies are outsourcing include their accounting systems, contact management systems, and calendar management systems. Other useful systems and applications created by start-up ASPs are coming online rapidly and being promoted vigorously. These include Salesforce.com, a sales force automation package; United Messaging, a full-service outsourcer of corporate e-mail services; and Push Inc., a Citrix iBusiness ASP, which builds both Web applications as well as full back-end functionality for dot coms.

The adoption of ASPs in Japan has been slow as compared with the U.S., but this hesitance is poised to change dramatically. According to a study performed by InQuiro International Limited and commissioned by the ASP Industry Consortium, small to medium-sized Japanese enterprises are gradually accepting the ASP model primarily as a result of the country's prolonged recession, which has forced businesses to review previously entrenched work practices in an effort to cut costs. Rather than enlarging the staff and technology resources of their IT departments, companies are finding that it is far more cost effective to outsource such operations as data management and storage, messaging, and desktop delivery of business applications to ASPs, which already have the hardware, software, and human resources in place to quickly develop and deploy them. However, even with this growing openness to technology outsourcing, the Japanese user market for ASP services - which Deloitte Tohmatsu estimates could be worth over 300 billion yen by 2004 - is lagging two to three years behind the U.S.

Before we go on, let's pause for a moment to take a closer look at the meaning behind the acronyms - SME and ASP.

According to the Tokyo Chamber of Commerce and Industry, SMEs comprise more than 99% of the Japanese economy. As far as the characteristics that distinguish an SME from a large corporation, they would include the following:

- A manufacturing SME would have a market capitalization below 300 million yen or would employ 300 people or less.
- A wholesale SME would have a market capitalization below 100 million yen or would employ 100 people or less.
- A retail SME would have a market capitalization below 50 million yen or would employ 50 people or less.
- A service SME would also have a market capitalization below 50 million yen or would employ 100 people or less.

Using the illustration of a real world product such as sake, the SMEs that would be involved in its chain of creation would include the distillers that convert the rice to sake, the bottlers of the sake, the printers of the labels for the bottles, the agencies that create the ad campaigns for the sake, the distributors of the sake to retailers and restaurants, the stores and restaurants that sell the sake to consumers - even the writer who tastes and reviews the sake for a magazine or newspaper. Each of these companies is an example of a Japanese SME, and all are potential users of ASP offerings.

ASPs, by definition, offer a combination of software, hardware, and networking technologies that deliver business applications through a Web-based interface to their customers. Along with providing the networking and IT infrastructure on which these applications reside, the ASP also coordinates hardware purchases, software licensing or customization, and customer network access. Applications and services are delivered and managed from remote data centers for multiple users via the Internet or private networks on a subscription or rental basis.

ASPs provide large and small companies with a number of significant operating advantages, including:

- Speed to market - by having the equipment, Web-based applications, and IT expertise already in place, an ASP can rapidly provide a company with the capabilities it needs to meet a competitors' e-commerce challenge.
- Focused operations - a company can concentrate on its primary business functions and dedicate critical resources to its core competencies by outsourcing its application management to an ASP.
- Improved financials - according to the ASP Industry Consortium, a company can save 30% to 80% on its application acquisition, implementation, and maintenance costs when outsourcing its specific technology needs to an ASP, versus investing internally to create the same technology. Additionally, by working with an ASP, a company can replace capital expenditures with pay-as-you go operational expenses.
- Reduced risk - an ASP can test a new technology for a company with minimal impact to the company's operations and finances.
- Improved performance - companies can benefit from an ASP's vast experience of providing reliable levels of availability, security, back-up, disaster recovery, and customer care to a diverse client base.
- Latest technology - ASPs can provide companies with rapid access to the most recent and most powerful applications and technology upgrades. ASPs also give companies access to cutting-edge applications that they might not otherwise be able to afford.

A recent quote in Internet Week magazine by Chuck Mueller, chief financial officer at PacificNet.com, illustrates the distinct advantages that an ASP can bring to a company.

PacificNet, incidentally, is a Minneapolis supplier of e-commerce services and technology for Asian trade.

"[Interelate, an ASP we hired to build and operate our data warehouse], got [it] up and running in three months," Mueller said. "I hear of [companies planning] these grandiose data warehouse projects [on their own] that are 24 to 36 months into development - and they have nothing to show for it."

With all of the powerful and apparent benefits that ASPs can bring to Japanese companies, one would think that the demand for their services would be massive. But there are a number of cultural barriers that have caused adoption of the ASP model to be hesitant, including:

- Unfamiliarity with ASP model - while in the U.S. the practice of using outside providers to handle technology applications is well-accepted, Japanese companies - particularly smaller ones - still struggle with this idea. To combat this discomfort level, Japanese businesses need to be educated about the previously discussed top line and bottom line advantages that application outsourcing can offer them.
- · Name recognition - there is a loyalty among consumers in Japan to traditional large companies, and SMEs are not immune from this mindset. Start-up ASPs will therefore have to dedicate substantial time and resources finding clients, since companies, smaller ones in particular, will not be comfortable with unfamiliar vendors. This obstacle can be overcome two ways: by the aggressive and successful branding of ASPs and their offerings in the marketplace; and by ASPs promoting and publicizing case studies of their successful implementations.
- Translation - ASPs that offer English language-based applications will find that the translation of their services from English to Japanese may create awkward results. A solution to this problem would be for ASPs to localize their offerings using humanware who are well-versed in the subtleties of the application's English version and especially the Japanese version. This localization would apply not only to the creation of a clear, concise translation of the application's interface and documentation, but also an overhaul of the single-byte character set used to represent English Latin letters into a double-byte system suitable for Asian languages, which use thousands of possible character combinations.
- Security - the security of hosted applications is of great concern to Japanese SMEs, which are cautious about placing their valuable data at an off-site location for fear that it is vulnerable to hacking, loss, or damage. The SMEs' anxiety about data security can be overcome by working with ASPs which have PKI in place. PKI, or public key infrastructure, requires users to use a digital key code in order to access the data - similar to the personal identification number that must be entered in order to withdraw money from ATMs. SME concern about the physical security of the ASPs' systems and hardware can be addressed with adequate security of the ASPs' data centers, which should offer back-up capabilities, bandwidth redundancy, earthquake resistance, and security personnel.

Along with the cultural barriers, there are also technological barriers that have prevented more rapid acceptance of ASPs by Japanese SMEs, including:

- High Internet connection costs - in territories where Internet connection costs are low, such as Northern Europe and the U.S., companies have readily embraced ASPs, which offer Web-based applications via broadband or DSL lines. In Japan, the high costs of connectivity are a major obstacle preventing the acceptance of ASPs. However, as these costs come down, SMEs will find the offerings of ASPs much more attractive. ASPs offering end-to-end network service will be in a prime position to offer reasonable rates.

- Network quality - for Japanese SMEs to embrace ASPs, the quality of the network carrying the hosted applications from the ASP to the SME must be of the same quality as that of a local area network. Given that much of the last mile connection in Japan's major urban centers is on NTT's copper wire system, network quality can suffer. ASPs must take advantage of a last mile infrastructure composed of fiber optic cables and other broadband capabilities to ensure high quality delivery of their hosted applications.
- Integration - SMEs are concerned that the hosted applications they subscribe to will not properly integrate with their internal legacy computer systems. Successful ASPs will have the foresight to design solutions - as well as the capabilities to integrate solutions - that will seamlessly integrate with their clients' systems. They will also have partnerships with - and certifications from - leading software manufacturers, which will not only provide the ASPs with proficiency in the applications that they're selling, designing, and installing, but also keep them abreast of any upgrades or developments to the technologies.

I'd now like to examine the current business situations of four companies: a start-up ASP seeking to build sales, an ASP that is thriving after a shaky start, and two companies that are successfully utilizing ASP services to build and streamline their e-businesses.

*

Technoweb is a Tokyo-based ASP that offers an online application called Edge24, which lets education providers establish, update, and access their courseware via a Web browser. The company's potential user base includes language institutes, vocational schools, adult education centers, corporate training centers, and other providers of educational services in Japan.

Technoweb originally offered Edge24 as an educational software package. After doing extensive research about their target market, however, the company discovered that up to 90 percent of their potential customers could not afford to build the necessary in-house IT infrastructure that could handle and manage the operation of the software.

While unable to handle the cost of buying the Edge24 software, Technoweb's potential customers were extremely open to the idea paying for the Edge24 service - in other words, renting it. Technoweb then decided to transform itself from a software vendor to an ASP.

Technoweb is presently in discussion with about a dozen potential customers, including management training and English conversation schools, about signing on with the ASP version of Edge24. The company will also seek to work with CPA training centers and large corporations, which would be able to publish all their in-house training documents using Edge24.

Technoweb aims to be fully in the black with Edge24 by next year.

*

A year ago, AlphaBrain was in a dilemma similar to that of Technoweb's early woes. AlphaBrain's flagship product, a database of manufacturing information and specifications for use in estimating costs on manufacturing jobs, was too expensive for the SMEs that the company was trying to sell to. The cost factor combined with the reluctance of these SMEs to automate a tried-and-true, paper-based cost estimation process pushed AlphaBrain to the brink of bankruptcy.

Today, AlphaBrain has successfully repackaged itself as an online engineering service provider with a Web-based parts estimation application called Alpha-8. Alpha-8 calculates manufacturing cost estimates, allowing SMEs to more effectively bid on buyers requests for quotes and made-to-order parts. AlphaBrain now enjoys the classic benefits that the ASP model provides, with customers paying a modest fee only for the service they need.

Encouraged by the success of Alpha-8, AlphaBrain will soon be launching AlphaEXchange, a B2B marketplace that will allow the firm to post tenders to the open market and process transactions with producers based on the cost estimates produced by Alpha-8.

*

Imagawa-Misawaya Online Broker, Ltd., a Japanese startup, benefited tremendously from the liberalization of online trading in 1999. This development, which made it possible for Japanese consumers to invest and trade online, resulted in a business boom for the company. Transactions such as new account openings, order placement, and order inquiries were communicated via e-mail by customers and required an electronic reply or confirmation from Imagawa's customer service center. The manual screening of and responses to this flood of e-mails became unmanageable as the company's customer base and trading volume surged.

Imagawa-Misawaya selected an ASP offering by eGain called eGain Mail as the solution to this problem. Utilizing rules-based screening software, eGainMail allows the proper load balancing among the customer service staff, provides a history of e-mail correspondences, and highlights those e-mails that required immediate attention.

In less than two months, Imagawa-Misawaya was able to fully implement eGainMail, which has helped the company to cut the service center's response time to customer e-mails by 50%.

*

RightFreight.com, an online business-to-business airfreight services exchange, provides reverse auctions for carrier services, including contract and spot shipment proposal processing. To differentiate its offerings from those of its competitors, RightFreight needed to address global trade in its business processes and offer more value-added services to its clients.

In December 1999, RightFreight selected a solution by U.S.-based ASP Vastera, which specializes in global trade and logistics applications. This solution, called TradeSphere, integrates mission critical global trade functions with value-added services such as restricted party screening, landed-cost information, and international document generation.

Using TradeSphere, RightFreight.com was able to create a fully-functioning Web-based exchange with global trade capabilities in less than eight weeks.

Incidentally, Vastera will making its services available in Japan in the near future.

As can be seen from the illustrations presented, ASPs can offer vast benefits to Japanese SMEs, and the business climate is right for the two acronyms to become better acquainted. New and valuable ASP services, created by young entrepreneurs at Keio University's Shonan Fujisawa Campus, are emerging quickly, due largely to the early exposure that these students are having to Internet technology courtesy of their Web-savvy professors. There's no need to explain to these future leaders of Japan's New Economy what the ASP model is or what it can do for such explosive areas as the wireless Web - they get it and they want to be a part it. And with their energy, as well as the eroding of the cultural and technological barriers to ASPs, Japan will emerge as a pioneer in ASP solutions for the Far East and the world.

Back to top of page **Back to the sessions page**

Simon Krieger

EVP, Service Development

Simon Krieger has joined Vectant in March 2000 as an EVP Service Development. Previously, he was president of WorldPartners Company.

Simon has 22 years of experience in the telecommunications industry and international business. He has held executive positions with AT&T, WorldPartners and Concert. He has also had leadership experience in Japan and Hong Kong, as well as the USA.

Simon was the President of WorldPartners Company, a joint venture of AT&T, KDD of Japan, Singapore Telecom and Unisource from its formation in 1993 until 1999. He transformed WorldPartners from an idea into one of the world's largest providers of telecommunications services, serving over 1000 global multinational companies. At Concert, a joint venture of AT&T and British Telecom, he was a vice president responsible for generating more than $1 billion in distributor revenues.

Previously, Simon was Regional Managing Director of AT&T Asia/Pacific Business Services located in Tokyo. Additionally, he was Managing Director of AT&T Japan Ltd and Managing Director of AT&T Hong Kong Ltd. While in Hong Kong, Mr. Krieger was co-founder and served on the Board of Directors of Hutchison - AT&T Network Services, which become part of the AT&T Asia - Pacific Internet business.

For ten years Mr. Krieger was a regular participant of Pacific Partners, an Asia/Pacific group of eleven leading carriers, and the AT&T Asia/Pacific Customer Advisory Council, a group of 35 leading multinational companies. Additionally, Mr. Krieger had experience with AT&T in the USA in Sales, Marketing, Product Management, and operations with primary emphasis in serving business customers.

Mr. Krieger received his M.B.A. and B.S. Engineering degrees from Cornell University. He received an Advanced Professional Certificate in Marketing Management from New York University and graduated from the Executive Program at the University of Michigan.

Simon and his wife, Robin, have two children and live in Westfield, NJ.

Back to proceeding page   **Back to the sessions page**

Designing And Planning of National Optical Network in China

Raymond H.M. Leung, Q.L. Ding, and Vincent W. Hung

Abstract

1. Introduction

In recent years, network applications have been evolving towards a more bandwidth-demanding fashion. Services like multimedia conferencing, video-on-demand (VOD) and Virtual Private Networks (VPN) are gradually gaining popularity. Facing these changes, network providers must not only guarantee that their optical transport networks can provide sufficient bandwidth for current demands but also ensure the bandwidth of their networks can be scaled up and meet the growing needs of the future. As the cost of laying new optical fibres is expensive, optical transport networks are moving towards a crucial milestone in network evolution: a network which provides higher and scalable capacity with reduced cost for network implementation and upgrade. This trend is also affecting the network planning and implementation in China.

China is one of the biggest countries in the world having a total area of 9,670,000 m^2. In recent years, the market share of data communication in the entire telecommunication sector in China has grown tremendously. For example, the number of Internet users was about 3.5 million till December 1999 in China; it will reach 40 million users by 2002. Various data services such as metropolis access networks; X.25; dedicated digital data lines; frame relay and ATM have also experienced tremendous growth in the range of 70~200% from 1998 to 1999 throughout the whole country because of the economic growth [1]. Therefore, the biggest telecommunication market in the world cannot be missed.

For years, the telecommunications infrastructure in China has been monopolized by government-owned enterprises. In recent years, in the effort to gain WTO accession, China has undergone a series of reforms in telecommunication industry. The reform has resulted in opportunities for foreign telecom operators and network investors to invest in telecom business in China.

2. Key Challenges and opportunity of planning national backbone network in China

China is amongst the largest countries in the world. It covers an enormous geographical area with vastly different terrain, infrastructure and population concentration. Its national population exceeds 1.2 billion. And its demand for communication bandwidth is growing rapidly. The combination of these factors creates challenges and opportunities alike for network investors planning to establish a backbone network in China.

Accommodate high traffic growth

The most noticeable challenge the network investor will face is the rapid growth of demand in data traffic. According to a report published by Ministry of Information Industry (MII) in China, the number of Internet users in China has reached 12 million by May 2000. It is expected to grow at a rate of 200% per year and reach 100 million by 2005 (Figure 1). The demand for other data services is also increasing. Research conducted by China Academy of Telecom Research indicates that the annual growth rate for Digital Data Network (DDN) is 156% and the growth of public multimedia telecomm networks is 248%.

Such a rapid growth in bandwidth demand is a great opportunity, and at the same time, a challenge, for network investors. To accommodate the growth in demand, the selection of network equipment and planning of network topology are essential to the success of the network. The rapid advances in electronic and optical technologies have shortened the life circle of network equipment significantly. Typical life circle of SDH and DWDM equipment nowadays is approximately 18 months. At present 2.5G technology are being replaced by 10G technology. In 2 years' time, 40G equipment will become the mainstream product. Meanwhile, the pricing level of these transmission products reduces every 6 months due to kin competition between equipment vendors. Facing such rapid change, network investors must have a thorough network deployment plan to account for cost effective upgrade of network bandwidth and smooth transition to newer technologies in the future.

Reduce network costs

One of the problems facing most of the network operators in China is the overlapping of investment in network infrastructures due to the lack of a thorough initial strategic planning. Investment was made on multiple networks each providing different services. For example, the operators would construct a switched-network for voice traffic, a dedicated ATM or Frame Relay network for multi-service data and an IP network for Internet services. The overlapped infrastructure increases the initial investment and the operating cost of the network.

In fact, it is not difficult to observe that among all the data services, the required underlying physical network infrastructure is identical. To reduce the cost of network construction and operation, a service-transparent network is a plausible solution. On top of this platform, multiple services supporting delay sensitive voice communications; jitter sensitive video transmission; mission critical data and best effort data can be provided [5].

Reduction of network cost can also be achieved by introducing an open architecture to the network. Network equipments from multiple vendors can operate in this open-architecture environment. Although extra investment may be needed to ensure interoperability among various vendors and to implement a unified network management system, The result is improved network performance with decreased equipment prices as such open environment often encourages price competition among network vendors. In addition, the equipment should be configured for value according to market demand and network utilization, it's not good to have standing idle bandwidth for long period.

Provide highly reliable services

Similar to other parts of the world, a high level of network reliability is a must for backbone network operators in China. Customers often demand 99.99%+ of network availability. This is difficult to achieve in China because of the sheer size of network coverage and the large quantity and types of network equipments within the links. This greatly increases the chance of partial network fault. Fiber links are also broken due to physical disconnections caused by construction projects and intentional sabotage that occurs occasionally at the initially developed location. As a result, fault protections are particularly important for networks.

Despite all the challenges, the prospect of investing in national backbone networks in China is still very attractive for network carriers. The most obvious reason is the huge potential for network applications in the market. At present, there exist a large number of commercial and non-commercial users demanding different QoS level on both ATM and IP services. The number is expected to increase further after China gains WTO accession. With the increasing demand, aggregated bandwidth in a network channel can be fully utilized more quickly. This lowers the cost per bit on trucking. Another advantage is the low cost of service provisioning. The costs of equipment installation, maintenance, equipment room allocation and other expenses such as salaries paid to local employees are all relatively low. Compared with most western countries, only 1/5 ~ 1/10 of the overall cost are needed in China. Another advantage not often found in other countries is the abundance of alternate routes that can be utilized for network fault protection. These fiber routes are constructed by the government and currently being operated by state-owned enterprises. By exchanging bandwidth from these routes, network fault protection can be improved.

3. Network Design and Planning

Overview of the Network

The new optical backbone network is a high-capacity transport network dedicated to provide broadband and bandwidth demanding data services for commercial and academic organizations in China.

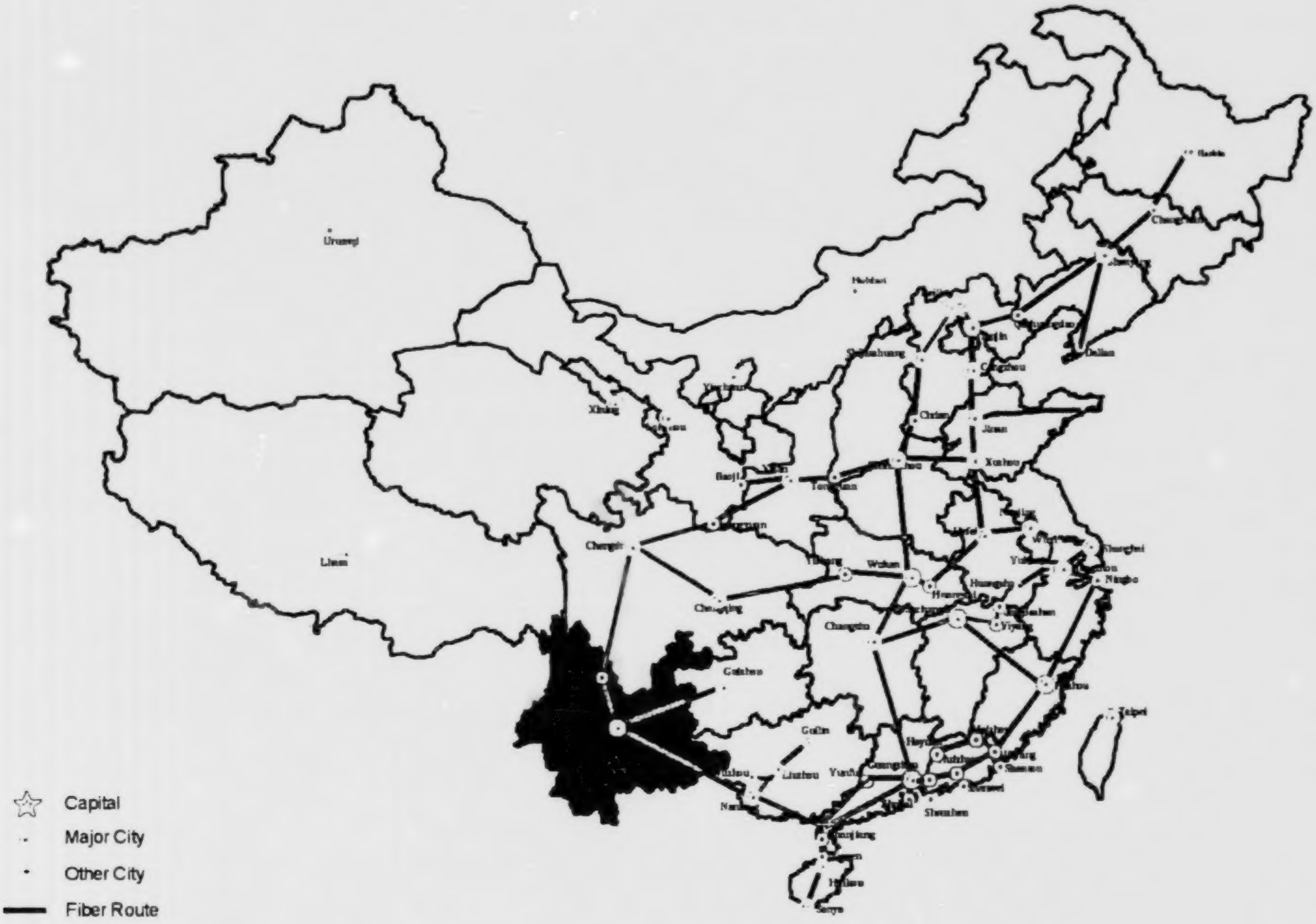

Figure 1: The new National Fiber Optic Network

As illustrated in Figure 1, the geographical coverage of the optical backbone currently spans over 25 provinces. The total length of the fiber cable is more than 23,000 km. This network connects more than 200 intermediate stations including all the major cities in China.

Network design considerations

To design and plan a transport network of such size for smooth and optimal network performance, it is vital to ensure the network reliability, scalability, connectivity, flexibility, expandability and equipment compatibility. At the same time, the cost-effectiveness of the network implementation must also be taken into consideration. These factors affect the design of network topologies as well as link capacity allocation and the utilized networking technologies. The detail of network planning will be discussed in the following section.

Unlike other part of the world, China is a very big country with multi-cultural and inter-regional problems as well as different operational policies for different region. Therefore network construction in China is restricted by strict policies, which are imposed by both central government and regional authorities. These restrictions must be accounted for during the design and planning.

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Migration of Network Technologies and Topologies

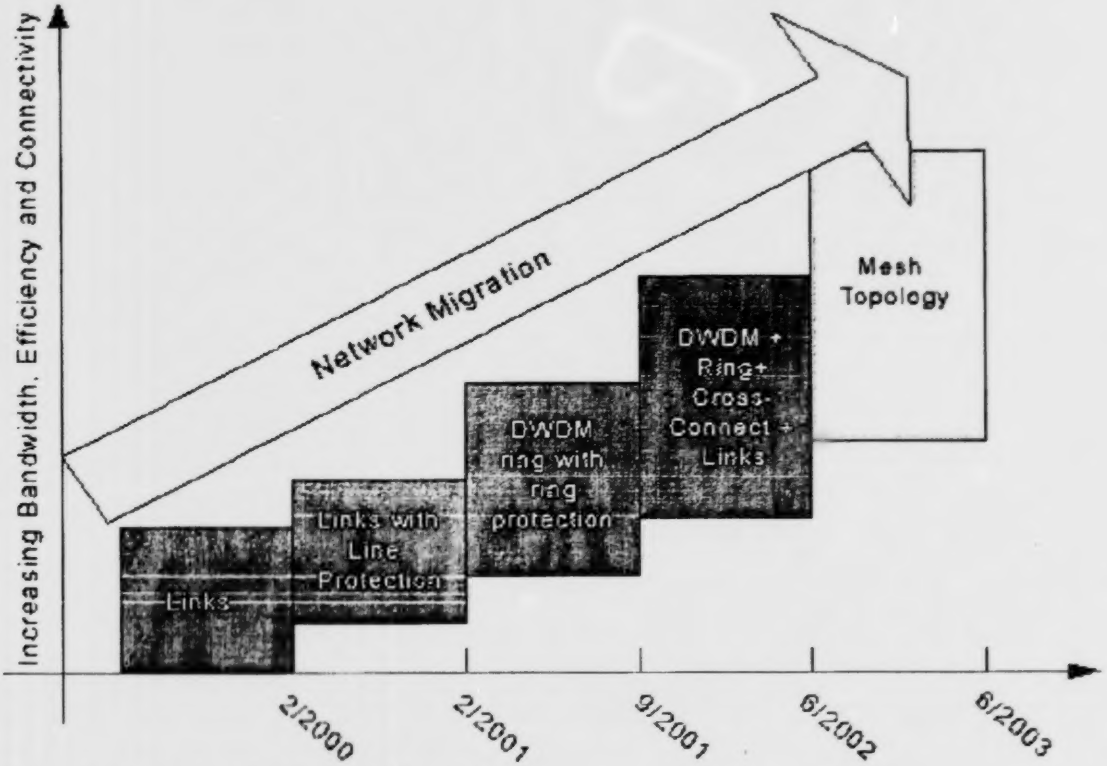
Increasing Bandwidth, Efficiency and Connectivity
Network Migration
Links
Links with Line Protection
DWDM ring with ring protection
DWDM + Ring+ Cross-Connect + Links
Mesh Topology
2/2000
2/2001
9/2001
6/2002
6/2003

Figure 2: Time Chart for Network Migration

To meet the requirements for network performance and bandwidth demand, the network is designed to have graduate improvement in terms of networking technologies, topologies and fault management capabilities over a period of 3 years. This is achieved through a series of migrations as illustrated in Figure 2.

Stage 1: Point-to-point Links running SDH

The first stage involves the realization of point-to-point optical connections of a number of network nodes. This has been completed before February 2000. On top of these optical connections, single wavelength point-to-point Synchronous Digital Hierarchy (SDH) services have been available since April 2000.

SDH is the current transmission and multiplexing standard for high-speed signals within the carrier infrastructure in Europe and Japan. The use of SDH on top of the optical channels has a number of benefits: the bandwidth management can be extremely flexible; data streams with various data rate can be multiplexed and demultiplexed easily; the SDH standard has specification of interfacing mechanism with different higher-level protocols such as ATM, IP and Frame Relay. With these specifications, it is easy for link subscribers to run services of their own thus increasing the flexibility of the network.

Within this stage, however, the optical backbones are not protected against line failure. This problem is solved in stage 2.

Stage 2: Point-to-point Links with Line Protection

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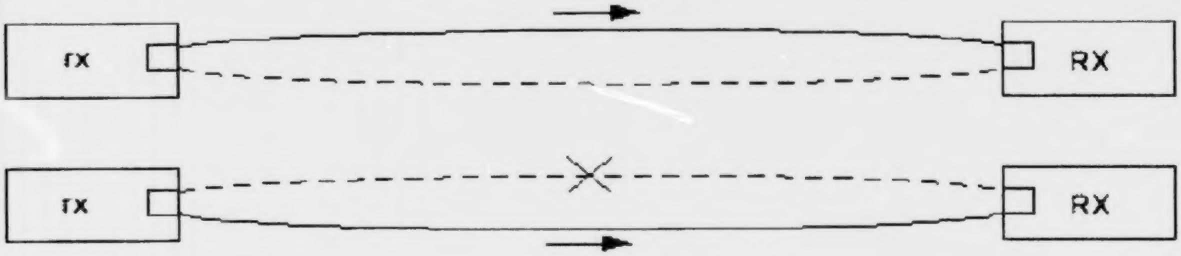

Figure 3: 1:1 Protection

SDH also specifies some network fault protection schemes for point-to-point topology. They include 1+1 and 1:1 protection schemes as illustrated in Figure 3. A generalized version of 1:1 is N:M, where N protection fibers are used to protect M working fibers. These mechanisms all require diverse fiber routes to the same destination to be available. Due to the high cost of laying optical fibers for long-distance transmission, it is economically inefficient and impractically to place multiple fiber cables to the same destination through different geographical locations. Thus path protection becomes difficult for a network carrier.

This protection scheme, however, can be implemented through co-operations among different network carriers. We are deploying a scheme in which the new network shares some of its bandwidth to other carriers and, in exchange, can utilize links of other carriers when necessary. Thus in case of link failure, the network can switch its traffic to the path of another carriers.

Stage 3: DWDM Ring with protection running SDH

To design a flexible transport network that can adapt to the growth in bandwidth demand in the future, the transmission capacity should be scalable and able to be upgraded with minimal cost. The viable solution for dynamically increasing the transmission capacity without physically increasing the number of fibres is to use Dense Wavelength Division Multiplexing (DWDM) technology [2, 3].

The paradigm shift from single wavelength to multi-wavelength transmission in the new network occurs in the third stage of migration. In this stage, DWDM technology is employed to transport SDH signals up to 32 wavelengths. The capacity of the network is expected to increase considerably.

Another major difference in this stage is the shift from a point-to-point network topology to a hybrid multiple-ring and link configuration. The ring configuration is a regular and restricted topology, no complicated routing policies would be required for traffic between different nodes. This makes the control and management of network resources relatively easy. Moreover, the ring structure allows networks to be protected from fibre cuts and node failures in a simple fashion in both path layer and multiplex section layer.

It is unfeasible to realize a nation-wide network using a single ring due to geographical limitations. We have therefore plan the network as 4 smaller rings and links, each of which can be operated and managed independently from the others with the supervision of a common network management system [4]. These 4 rings link about 200 major cities in China as illustrated in Figure 4.

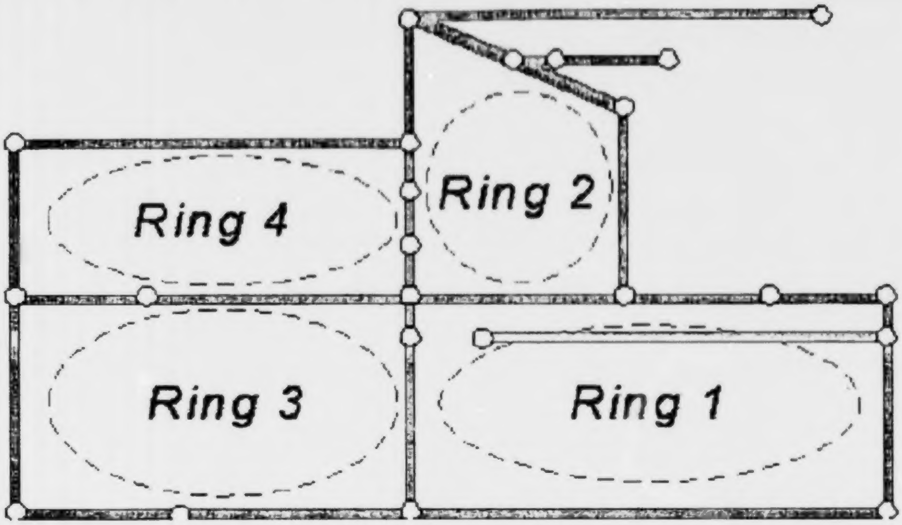

Figure 4: Hybrid link and Ring configuration

Stage 4: DWDM Rings with Cross-connects

The rings realized in stage 3 are still too large and they pose some potential problems to network operation. For example, SDH network requires synchronization of the incoming and outgoing data for multiplexing and de-multiplexing. Synchronization is usually achieved through a synchronization network, which is used to distribute precise clock signals to all the network nodes. A large ring spanning across one forth of the entire network is difficult to synchronize as clock signal need to travel long distances. Another foreseeable problem is the efficiency of utilization due to low connectivity between network nodes.

The solutions to these problems lie in the fourth stage of network migration. In this stage, new fibre trunks interconnecting network nodes will be deployed. Using these cables, numerous smaller rings can be formed making the bandwidth utilization more efficient and synchronization easier and reliable. SDH Digital Cross Connect (DCS) or Optical cross-Connect (OxC) can be used to facilitate traffic between adjacent rings to increase the network efficiency, flexibility reliability and network connectivity.

Finally, we envision the deployment of OxC or MEMS-based all-optical switching matrix in the backbone to realize a DWDM mesh network. This will increase the network reliability, connectivity and resource utilization considerably.

With this migration process, we are gradually building up an increasingly reliable, scalable and flexible optical backbone network with high connectivity and reliability for the blooming telecommunication market in China at an affordable pricing level.

4. Current Operational Status

At the current stage of development, the new network employs 2.5G SDH network technology and forms a link topology. It carries point-to-point data traffic among major cities, particularly in the eastern part of China, as illustrated in Figure 5. Due to the rapid economic growth in this region, the demand for data traffic is expected to increase in an accelerated rate. The forecast in traffic demand indicates a 170% growth for the network within 2 years as shown in Figure 6. The network is estimated to reach its full capacity by the end of 2000. DWDM equipment has been installed in the main trunk of the network to satisfy bandwidth requirement. By June of 2001, full DWDM with 10G SDH will be deployed for the whole network.

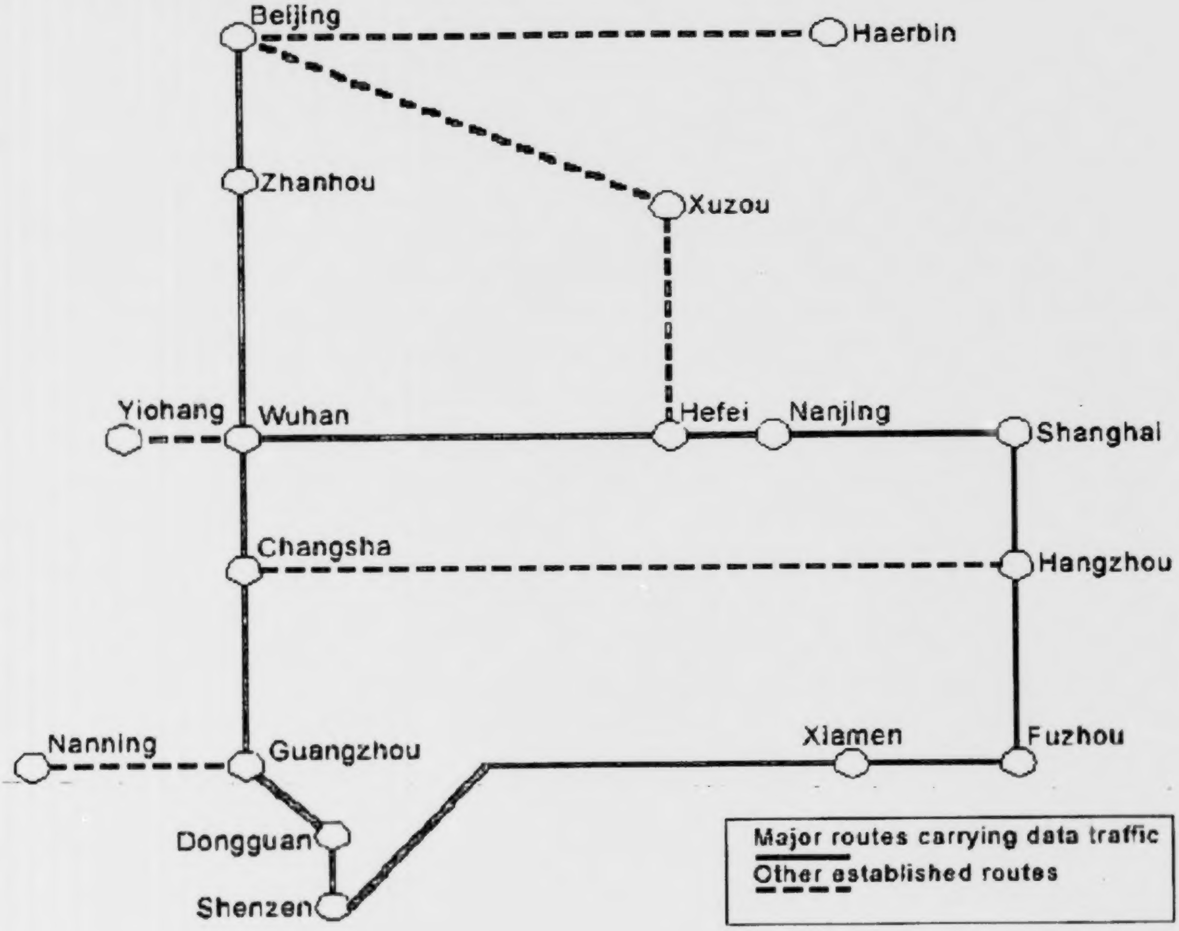
Beijing
Haerbin
Zhanhou
Xuzou
Yiohang
Wuhan
Hefei
Nanjing
Shanghai
Changsha
Hangzhou
Nanning
Guangzhou
Xiamen
Fuzhou
Dongguan
Shenzen
Major routes carrying data traffic
Other established routes

Figure 5: Current network configuration and traffic routes

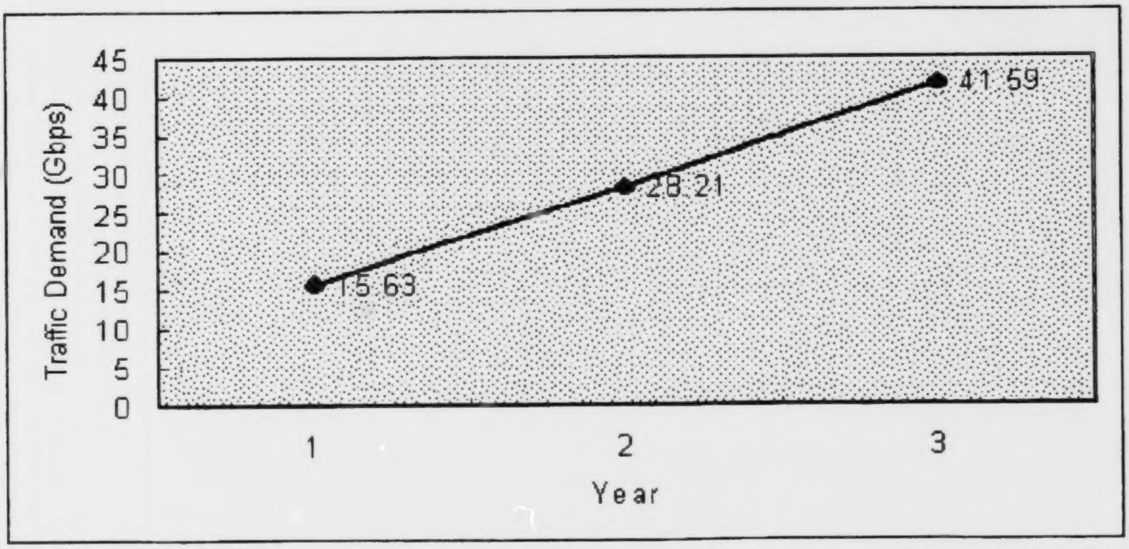

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Figure 6: Forecast of Total Traffic Demand for the new Network

In the service availability aspect, the new network has encountered and overcame a number of problems during the initial stage of network operation. Among them, frequently broken links and various equipment faults are the serious faults that affect the performance of the network. After a few months of improvement, network availability has reached 99.8% in July 2000 as shown in Figure 7. After the alternate route scheme is implemented, the reliability can be further improved to reach an availability of 99.99% or better. To increase the reliability and stability to a carrier-of-carrier level, self-healing ring architecture will be needed and is expected to be implemented in early 2001.

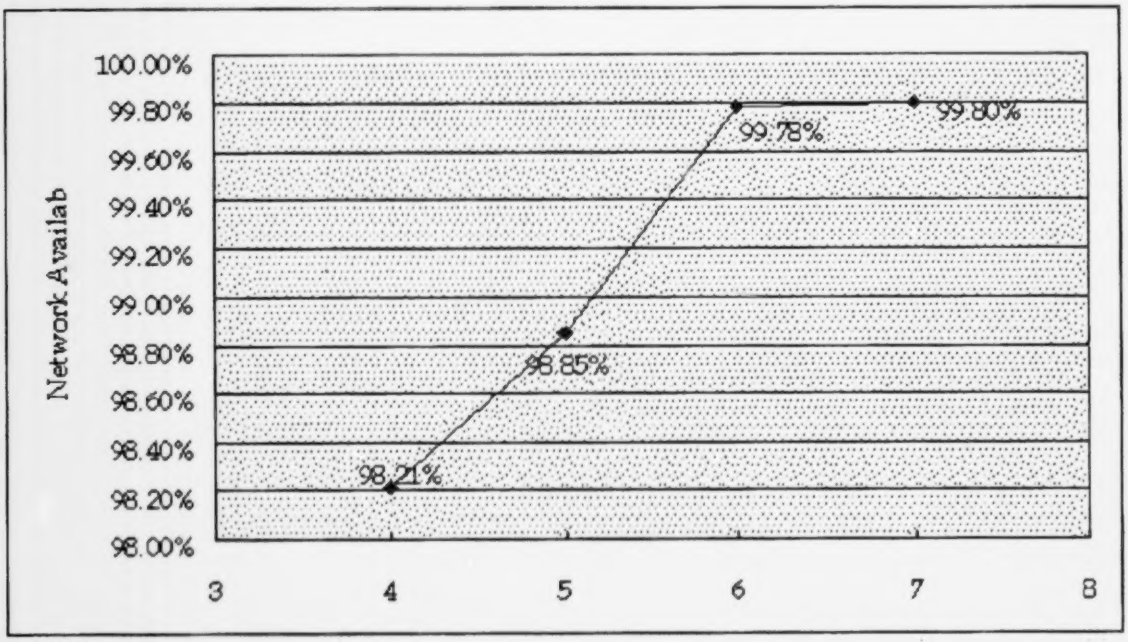

Figure 7: Service Availability in Month 4 - 7, 2000

5. Conclusions and Remark

In this paper, we shared the considerations and the experience gained in the design and planning of a new national network in China. We approach the design and planning of the network in a conservative and, at the same time, progressive manner. The network has been designed with good scalability and reliability in mind. We realize the importance of good network management, good support for maintenance and repair, as well as strong support for customer relationship management.

In directly relationship to the growth in traffic demand, new technologies in optical transmission will be deployed in the near future in order to optimize the cost outlay of the network with the ultimate objective of realizing a flexible and cost-effective national backbone network that provides bandwidth at a low price to the market in China.

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Back to top of page **Back to the sessions page**

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Mr. Raymond Leung is a qualified Fellow Engineer of ICE, IMgt, ASCE, HKIE, he is working in the area of telecommunication and fibre optics networks for recent 8 years, and now is enrolling Ph.D program in Information Engineering. He is presently Senior Advisor to the board of One Trend Net Limited, HengTong International Leasing Co., Ltd. and Techno Factor (development) Ltd. In addition to his professional activities, Mr. Leung is also involved in a number of Boards and Committees---Council Member of China Overseas Friendship Association, Member of Political Consultative Conference of HuBei Province, Fellow and Council Member of Hong Kong Institute of Arbitrators.

Back to proceeding page **Back to the sessions page**

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Dr. Ding Q.L. received his B.Eng. and M.Eng. degrees in electrical engineering from Xidian University, Xi'an, China, in 1982 and 1987, respectively. He got Ph.D. dgree in electrical engineering from The Chinese University of Hong Kong in 1997. From 1982 to 1987, he was a Lecturer and research staff in Xidian University. In 1990, he joined the National Key Laboratory of the Theory and Technology of ISDN, where he engaged in the design and implement integrated service of LANs, wireless LANs and ATM switch. After he got Ph.D degree, he joined Centre for Wireless Communications, National University of Singapore as a Member of Technical Staff. He was working on broadband communication network (R&D) in both wired and wireless for 14 years. He is now with OneTrend Net as Senior Engineer. He is member of IEEE and member of IEEE Comm. Soc.

Back to proceeding page **Back to the sessions page**

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Mr. Hung received his B. Eng in Information Engineering from the Chinese University of Hong Kong (CUHK) in 1998. He joined the Lightwave Communications Laboratory in CUHK as a research staff in the same year. During his stay in the laboratory, he has involved in a number of research projects in the area of network fault management and ultra-fast fiber optic access networks based on TDM and WDM. As a result of the research work, he obtained a M. Phil. degree in information engineering in 2000. He is now with One Trend Net as an Engineer. He is a member of IEEE Communications and LEOS society.

Back to proceeding page **Back to the sessions page**

Evaluating the Market for Internet Access Services and e-Commerce in South Korea

Simon Bureau

Abstract

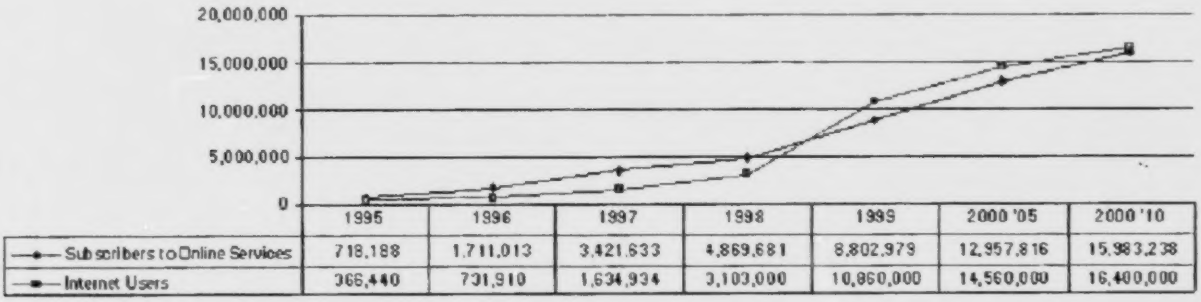
www.vectis-intl.com

Fueled by the economic recovery, Korean Internet and e-Commerce companies have transformed the structure of the market, creating significant opportunities to profit in this increasingly competitive environment. Judging from some of the world's fastest rate at which Koreans have in the past adopted new technologies such as wireless telephony services, Internet and more recently broadband access, the development of e-Commerce should accelerate in the near future. In addition, having just recovered from the economic crisis and with a market at times inefficient, e-Commerce has enormous potential to change companies and the way they do business.

Internet Services in Korea

With an Internet user base of over 16.4 million as of October 2000 (up from 1 million in 1997), Korea represents one of the largest addressable Internet markets in the Asia-Pacific region. The number of Internet domains went from 10,000 in 1997 to 500,000 currently, most of which are using the extension co.kr. The number of domain names registrations is growing at 20% per month.

Growth in Internet Users and Subscribers to Online Services in Korea (1995 to October 2000)



	1995	1996	1997	1998	1999	2000 '05	2000 '10
—◆— Subscribers to Online Services	718,188	1,711,013	3,421,633	4,869,681	8,802,979	12,957,816	15,983,238
—■— Internet Users	366,440	731,910	1,634,934	3,103,000	10,860,000	14,560,000	16,400,000

Source: Ministry of Information and Communications, Vectis International

The growth rate in Internet subscribers has significantly accelerated since the beginning of 1999, so is the number of Internet Services Providers (ISPs). Twenty-five new ISPs were launched since the beginning of 1999, bringing the total number of commercial ISPs to 48 (14 other non-commercial exist). Pureplay ISPs face a growing number of challenges in this highly fragmented market. To date, most ISPs are unprofitable, which points to imminent industry consolidation.

Foreign ISPs have already entered the market, the most notable examples being PSINet, which acquired Inet in 1998 and Cable and Wireless Asia (CWA), which in the 4th quarter of 1999 established Cable and Wireless Network Korea to provide dedicated and dial-up Internet access to business customers.

Key Internet Statistics

	1996	1997	1998	1999 .	2000.04	2000.10
Number of ISPs	16	21	26	54	62	62
Number of Internet Users	731,910	1,634,934	3,103,000	10,860,000	14,560,000	16,400,000
Revenues from Internet Services (Won Million)	19,400	53,687	88,756	219,967	n.a.	n.a.
Average Revenues per ISP (Won)	1.21 billion	2.56 billion	3.41 billion	4.07 billion	n.a.	n.a.
Average Revenues per Internet User (Won)	26,506	32,837	28,603	20,255	n.a.	n.a.
Number of .kr hosts	73,194	131,005	177,299	460,974	n.a.	n.a.
Number of .kr domain names	2,664	8,045	26,166	207,023	405,382	487,103

Source: Ministry of Information and Communications, KISDI, Vectis International
Note: Exchange rates: 1998: Won 1,200 = 1US$; 1999 & 2000: Won 1,110 = 1US$

With an ability to provide their subscribers with proprietary local content, Korea's five online services providers (OSPs) are also capturing a large portion of Internet subscribers. All have set up portal cybermalls while chatting, web hosting and free e-mail have now become standard services, all in an effort to broaden revenues sources and leverage their subscriber base. Others have even integrated international voice resale to their service offerings.

Despite such enhanced service offerings, the OSP business model is being challenged as well by the growing demand for broadband Internet access. Evidenced by the acquisition in early 2000 of Nowcom, Korea's fourth largest online services providers by Thrunet, the trend is set for OSPs to incorporate broadband access solutions.

Online Services Subscribers (as of October 2000)

Online Service Providers	Subscribers	Market Shares
Chollian (Dacom)	3,735,824	23.4%
Unitel (Samsung)	3,540,728	22.1%
Hitel (Korea Telecom)	3,424,121	21.4%
Netsgo (SK Telecom)	2,181,692	13.7%
Nownuri (Thrunet)	1,787,118	11.1%
Channel i	1,313,755	8.2%
Total	15,983,238	100%

Source: Ministry of Information and Communications

The Market for Access Services

Internet users are increasingly migrating towards broadband access, away from traditional narrowband dial-up access. As a result, demand for broadband access has exploded. Facilities-based carriers Korea Telecom, Hanaro Telecom, Thrunet, Dacom and Dreamline are now offering either or both ADSL or cable modem access modes. Following a decision during Summer 2000 by the Ministry of Information and Communications (MIC) on the terms of network access, all ISPs and Online Services Providers are now able to offer their subscribers high-speed access services.

Korea is undoubtedly Asia's fastest growing broadband Internet access market in Asia, and one of the fastest in the world. With a subscriber base over 3 million in October 2000 and growing monthly by 25%, the number of broadband access subscribers could reach 4 million by January 2001.

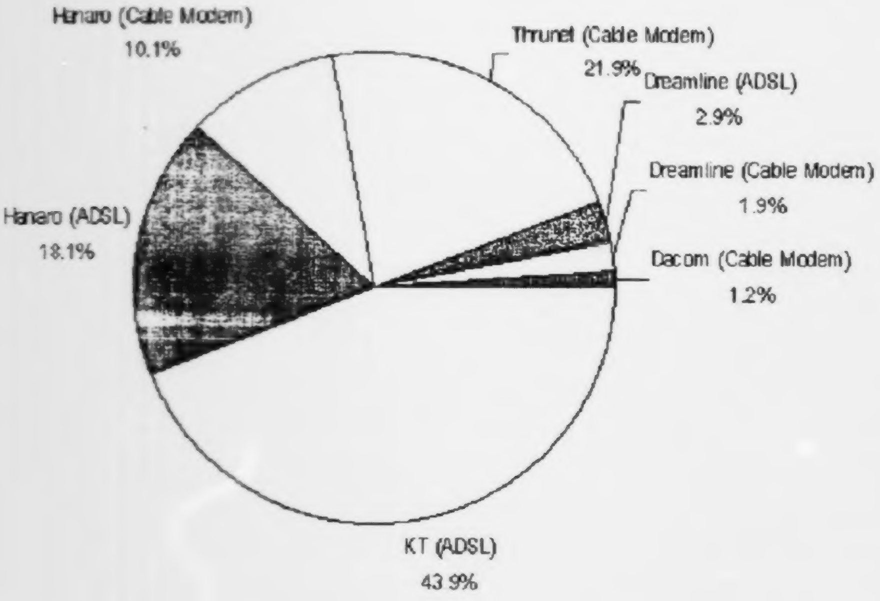
Key Broadband Internet Access Statistics (as of October 2000)

	Korea Telecom	Hanaro Telecom	Thrunet	Dreamline	Dacom	Total
ADSL	1,301,580	536,802	0	85,709	46,483	1,970,574
Cable Modem	0	299,245	649,149	55,800	35,376	1,039,570
Total	328,516	382,849	348,519	60,000	28,121	3,010,144

Source: Ministry of Information and Communications, Vectis International

The following Figure shows respective market shares of individual access providers by access modes.

Market Shares of Broadband Access Services (May 2000)



Source: Ministry of Information and Communications, Vectis International

The State of e-Commerce in Korea

The growth of e-Commerce in Korea is lead by a vibrant "venture company" industry, supported either by private capital but often by large business groups (*chaebols*), which points to a potential dominance of this sector. This phenomenon is likely to continue and accelerate because larger business groups have the resources, market clout but mostly because they have much stronger brand names and notoriety. In addition, the stock market underwent a serious downturn since the beginning of the year and as a result, financing through IPOs has become a distant possibility for independent entities.

B2C e-Commerce

While sales by cybermalls have doubled in 1999, to date online brokerage is one of the most active segment with revenues exceeding US$ 500 million in 1999. In the first ten months of 2000, the online stock trading volume increased 143% compared to the same period in 1999. For October 2000, online trading on the Korea Stock Exchange represented 57% of total volume and 75% of all stocks traded.

According to official statistics, there were over 1,700 B2C shopping malls as of June 2000 in Korea. B2C site operators are characteristically over-optimistic about sales targets. Despite the large number of sites, the market remains highly fragmented. The top 7 sites accounted for over 90% of all sales. Only about 4% of all B2C sites manage to break even or to make a profit. With average returns on sales of only US$ 60,000 in 1999 and with typically 3-4 employees, smaller cybermalls lack purchasing power and online retailing expertise, needed to succeed. In addition, close to a third of all B2C sites did not make a single sales transaction during the month of June 2000.

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Selected Major B2C Internet Sites in Korea

	Description	Sales 1999	Sales Target 2000	Ownership & Affiliation
Hansol CSN www.hansolcsn.co	General B2C site, the company recently added several parallel sites to focus on product segments and Internet broadcasting	K won 90 billion	K won 200 billion	Hansol Telecom
Samsung www.uniplaza.co.kr	General B2C site; The company plans to establish separate specialized shopping malls;	K won 70 billion	K won 200 billion	Samsung Group
Interpark www.interpark.co.kr	One of Korea's first online shopping mall to be established. It is active in several retail segments	K won 9.7 billion	70 billion	Spin-off from Dacom, publicly traded
Metaland www.metaland.com	Integrated B2C shopping mall offering other value-added services such as discount international long distance services	K won 8 billion	30 billion	Thrunet, Hyundai Dept. Stores, publicly traded
i39 www.i39.co.kr	B2C site affiliated with LG Home Shopping (Cable TV) and an integral part of LG's distribution networks (LG Mart)	n.a.	n.a.	LG Home Shopping (LG Group)
Lotte.com www.lotte	Online shopping affiliate of the Lotte Group's integrated retail channels (convenient stores and supermarkets)	n.a.	n.a.	Lotte Group

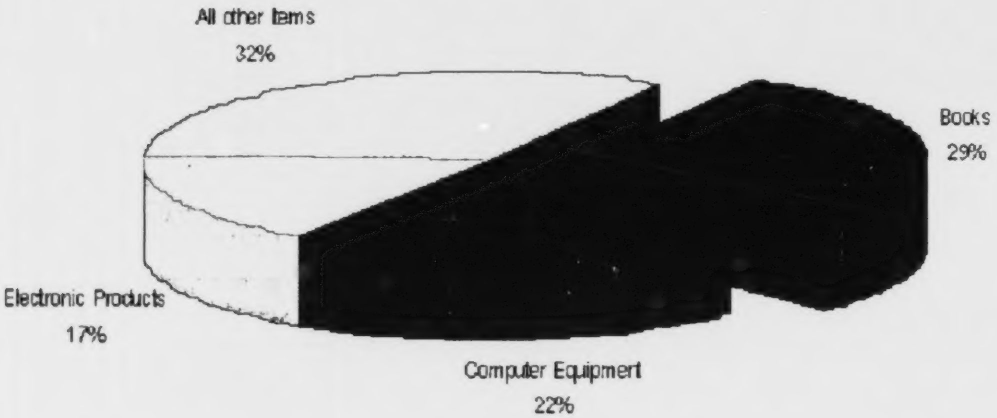
Source: Vectis International
Note: K won 1,110 = 1US$

While the majority of B2C sites are broadline oriented (selling products from multiple segments of the traditional retailing industry), more and more sites focus on specific retail segments. This is the case for online bookstores. There are currently over 150 online bookstores in Korea. In general, online bookstores can be classified into two categories: First, pureplay online bookstores (Yes24.com, Aladdin.co.kr), which the majority was established in the past 12 months. Second, online bookstores, which are extensions of existing brick-and-mortar companies, such as Kyobo, Youngpoong and Chongno.

Pureplay online bookstores generally sell at a 25-30% discount over traditional retail prices. They have so far been only been somewhat profitable. However, their existence is being challenged by a recent dispute with Korea's largest offline bookstores over the mandatory fixed retail price system that has been in effect in the market for several years. Major bookstores announced in November that they would not carry books published by companies that supply their books to on-line bookstores as well. Sales of online bookstores only represent only 5% of total book sales in Korea, but major bookstores are determined to keep the status quo in the industry, despite strong critics by consumers groups and comments made in favour of online bookstores by the MIC.

Breakdown of Sales of B2C Sites by Products in 1999

Source: Korea Information Society Development Institute (KISDI)



Major Issues Facing B2C Shopping Malls in Korea

- Lacking expertise in technical, managerial and marketing areas;
- The vast public is still not buying in large proportions. Unlike some other countries, security and online payments are believed to be the biggest barriers to a wider acceptance of e-Commerce by Koreans;
- Logistics and distribution represent major problems and Korean B2C shopping mall operators find themselves increasing required to form alliance with offline companies to provide better order fulfillment;
- Most B2C operators put stronger emphasis on marketing and advertising rather then on order fulfillment functions;
- A sizable proportion of consumers are unsatisfied with B2C shopping malls. Besides complaints about delivery delays, problems with poor quality of goods or the delivery of second-hand products remain the highest;
- Most large B2C shopping malls offer very little product and service differentiation;
- The market is excessively fragmented and wide restructuring, consolidation and bankruptcies are inevitable.

Source: Vectis International

B2B e-Commerce

During the first portion of 2000, not a single week went without an announcement of a "major B2B marketplace" by one of Korea's large business groups or trade associations. According to government sources, there were 170 B2B marketplaces in Korea as of mid-August 2000, of which only 24 were in operation. Over half of such initiatives are extensions of brick-and-mortar companies while the remainder is pure-play B2B online entities. B2B initiatives are more often designed to focus on vertical segments (textile, steel, etc.). For this purpose, consortiums are being created, which are often composed of traditional competitors.

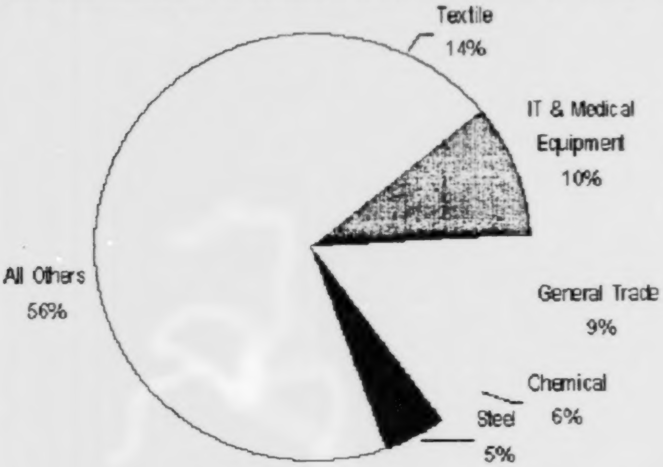
Figures on the size of the B2B market in Korea are considerably lower compared to other markets. Several problems have so far limited the establishment of other initiatives and slowed the progression of the existing ones. As in many other Asian countries, Korea suffers from a shortage of e-Commerce literate work force in terms of technical, managerial and marketing skills. In addition, few of the existing B2B e-Commerce projects in operation have a sustainable business model. Management is often unable to articulate a clear path to profitability and to react to competitors. Too often, partners have conflicting interests or expect government support.

Selected Major B2B Market Places in Korea

	Description	Ownership or Affiliation
Silk Road 21	Boasts 30,000 small and medium enterprises and is supported by the government	Wide-spread consortium
KTNET	Export-focused B2B marketplace for small and medium import-export firms;	KTNet belongs to a non for-profit industry association of small and medium import and export trading companies, which was initially established to provide EDI services to its member firms
Asia Ventures B2B Ltd.	Consortium established in July 2000 to pursue opportunities in B2B and foster the creation of venture companies developing core B2B-related technologies	SK.Group, Kolon Group, Hyundai Development and Trigem Computer
Ehitex	Described as the world's largest electronics B2B company (capital of US$ 100 million)	12 companies including Samsung, HP, Compaq, AMD, NEC
B2BClub	B2B company with a broad range of products and services	Hansol CSN and others

Source: Various industry sources, Vectis International

Distribution of B2B Marketplaces in Operation or Announced by Sector (As of August 2000)



Source: Ministry of Commerce, Industry and Energy, Vectis International estimates

Major Issues Facing B2B Marketplaces in Korea

- Lack of Expertise in Technical, Managerial and Marketing areas;
- Most B2B initiatives are in development stages and are highly dependent on government contributions and promotion;
- Newly established B2B marketplaces are often formed of traditional business rivals. Such cooperation may be unlikely in an environment of heated competition and conflicting interests between business groups;
- Lack of standardization among players and industrial sectors for product codes, electronic catalogs, electronic forms

Source: Vectis International

Mobile Commerce:

Korea enjoys a relatively high disposable income. It has the 6th highest mobile penetration rate in the world (57%), low mobile rates and a competitive environment, which encourages the rapid development of innovation in services to subscribers. These ingredients have the potential to make mobile commerce the most promising area of e-Commerce in Korea.

After a long and costly handset subsidies war, the government has forced Korea's five mobile operators to limit the level of subsidies and abolish minimum contract periods. As a result, wireless operators are now shifting their strategies away from price competition towards the bundling of services. Bundling usually include a combination of wireline services, Internet access and other data services.

Broadband Internet access is also experiencing strong growth from wireless access technologies. To date, all 5 Korean mobile operators have deployed IS-95A and/or IS-95B technologies providing subscribers access rates of 54kbps and at least three operators will offer access speeds of up to 144kbps from Q1 2001, when their networks are fully upgraded to IS-95C standards.

In addition, the government plans to award 3G licenses (IMT-2000) by late December 2000. Once in service in Q2 2002, IMT-2000 services are predicted to trigger renewed demand for wireless Internet access. Finally, three B-WLL (LMDS) were awarded and limited commercial operation or tests have begun since Q4 2000.

Mobile Internet Subscribers (as of October 2000)

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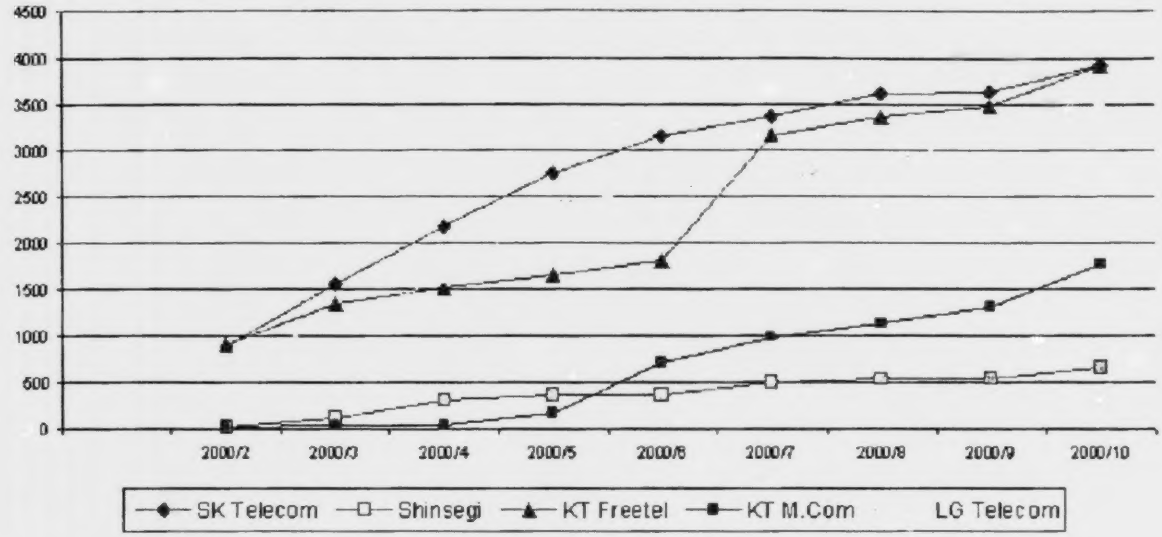

Source: Ministry of Information and Communications, Vectis International

Wireless Subscribers and Internet Users Statistics in Korea (as of October 2000)

	SK Telecom	Shinsegi Telecom	KT Freetel	LG Telecom	KT M.Com (Hansol M.Com)	Total
No. Of Voice Subscribers	10,941,294	3,559,824	5,146,359	3,795,374	3,036,171	26,479,022
No. Of Wireless Internet Subscribers	3,920,000	656,000	3,916,000	3,441,000	1,766,000	13,699,000
Percentage	35.8%	18.4%	76.1%	90.6%	58.2%%	51.7%

Source: Ministry of Information and Communications, Vectis International

Mobile operators have a tendency to adopt a "me-too" strategy. When a company comes up with a new service or content, rival firms often copy it. As a result, the types of services that are offered by each operator tend to be very similar, out of competitive pressure as well as out of fear of not being able to offer the same services, regardless if such services are profitable.

Virtually all services and content offered by mobile operators are aimed at the "n-generation", i.e. subscribers between the ages of 15 and 25. Operators focus all their efforts at marketing wireless Internet services to those subscribers mainly because they are considered to be early adopters of technology and trendsetters. On the other hand, other segments of subscribers (mainly in the 30's and 40's) have not demonstrated strong inclination for using mobile Internet services. According to surveys, this is mainly due to two factors: difficulties using current handsets and the very limited amount of content available corresponding to their needs and preferences.

While mobile operators generate revenues from airtime, the vast majority of the content available is free itself. Animated comic characters and customized ring bells downloaded to one's handset are the only two types of content that are actually being sold.

Type of Content and Frequency of Usage by Mobile Internet Users

Types of Contents	Rate
Email	72.0%
Text Message	68.1%
Games (Tamaguchi, Battle, Chatting games)	50.0%
Humour	31.9%
Search	30.1%
Chatting	29.0%
Entertainment	27.8%
Fortune Telling	26.9%
Weather	26.9%
Newspapers, Magazines, etc.	24.4%

Source: Enable Magazine

This is leading to a situation where content providers (CPs) cannot earn enough revenues from mobile operators to sustain their activities. Most of them are still living off the proceeds of their IPOs and will not survive unless a more equitable is implemented, such in the case of i-mode in Japan. Such a system would be to the advantage of operators as well, as they depend on CPs for a regular flow of new and attractive content for their subscribers.

While still limited, mobile commerce is becoming more prevalent and purchasing patterns resemble those of fixed Internet users.

Top 10 Products purchased via Mobile Internet

Products	Rate
Tickets (Movies, concerts, etc.)	43%
CD / video cassettes	38.6%
Books	28.7%
Cosmetics	22.5%
Flowers	19.8%
Clothing	12.6%
Accessories	12.6%
Gift items	12.6%
Sporting goods	4.4%
Others	9.9%

Source: Enable Magazine

B2B Mobile Commerce

To this date, very few efforts have been made to develop B2B m-Commerce initiatives in Korea, mostly because mobile operators have been developing the market for B2C with younger subscribers. These subscribers represent a clear and present revenue base to operators in need of revenues to finance their approaching 3G ventures.

However, significant opportunities exist, particularly in the transportation and logistics industry. Korea's five mobile operators have so far taken a relatively passive role, limiting themselves in most cases to providing wireless transmission services to corporate end-users as part of projects developed by independent mobile systems integrators. Some have more recently taken more active roles developing projects involving telemetry or the integration of payment processing systems.

The market for B2B mobile commerce in Korea is characterized by the fact that potential users of wireless applications are not aware of the possibilities the technology offers. At the same time, only a small number of systems integrators are capable to integrate more complex mobile-commerce solutions or applications.

The market is also being renewed attention by Korea's three wireless data communications services providers, Air Media, Intek and Hanse Telecom. They are now competing against their mobile wireless rivals and developing innovative services specifically aimed at corporate users. At any rate, the market will likely continue to be driven by systems integrators and corporate end-users.

Back to top of page Back to the sessions page

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Mr. Bureau is Managing Director of Vectis International Inc., an independent firm that provides business development support services to telecommunications and information technology companies in the Asia-Pacific region. Simon has worked and lived in Korea on different occasions since 1986.

Before founding Vectis, he worked with Canada's Teleglobe Inc., where he had responsibility for corporate development and business intelligence. In 1995 and 1996 he was seconded by Teleglobe to the "Global Information Infrastructure Commission" (GIIC) in Washington, D.C. Previously, Simon worked with the Asia-Pacific Support Group of NYNEX Network Systems in New York and in international finance for a major Korean company in Seoul.

He holds a B.B.A. in Finance from Bishop's University and a M.Sc. in International Business from l'École des Hautes Etudes Commerciales (HEC), where he has been a visiting lecturer. He has also studied at Yonsei University in Seoul and is proficient in Korean.

Simon was the organizer and producer of two Telecom & IT conferences in Canada and is also a regular speaker at conferences such as the ITU's TELECOM, PTC Annual Conference, APEC SME Forum, the Annual Internet Society Conference (INET), the Asia-Pacific Policy and Legal (APPLe) Workshop and the Institute for International Research (IIR) conferences.

Back to proceeding page **Back to the sessions page**

Program

@ Technology

Wednesday, 17 January 2001
0830–1000

W.1.4 Enhancing Wireless

Location: South Pacific II

Chair: RAMIN KHADEM, Chief Financial Officer, Inmarsat Ventures Limited, *United Kingdom*

W.1.4.1 Next Generation Wireless: Emerging Market Opportunities

SCOTT CHASE, Publisher & Executive Editor, The Strategis Group, *USA*

W.1.4.2 Efficiency Improvement of Channel Element Utilization Through a New Radio Access Network (RAN) Architecture of IMT-2000 System (ABSTRACT)

CHANG-YEUN ONE, Researcher, CHEOR-BEOM PARK (Presenter), IMT-2000 Development, SK Telecom, Republic of Korea, and HYUNG-ROCK PARK, Senior Manager, IMT-2000 Development Group, SK Telecom; and WHAN-WOO KIM, Professor, Chung-Nam National University, *Republic of Korea*

W.1.4.3 Bringing IP to Mobile: The Network Revolution of Internet and Wireless Convergence (ABSTRACT)

BO HEDFORS, Executive Vice President, Motorola and President, Global Telecom Solutions Sector (GTSS), Inc., *USA*

Next Generation Wireless Emerging Market Opportunities

Click here to start

Table of Contents

Author: Scott Chase

Next Generation Wireless Emerging Market Opportunities Scott Chase President and CEO The Strategis Group PTC 2001, January 18, 2001 schase@strategisgroup.com

Technology Overview

Network Migration Paths

Data-only Networks

Short Message Service (SMS)

Japan's I-Mode Growth

Market Evolution

Market Dynamics

Demand Drivers And Inhibitors

Ratio of Wireless and Internet Subs

Global Wireless Subs by Technology - 1999-2006

Global Wireless Internet Subs by Region (2000-2007)

Japan's Cellular Subs, 1990 - 1999

U.S. Mobile Data Subs, 1991-2004

Worldwide Cellular: Overall Growth

Worldwide Cellular: Subs by Regions

Device Platforms

Mobile Applications Evolution

Accessing Mobile Applications

Push Vs. Pull Models

Corporate Data Access

Enabling Mobile Data Applications

Need for Next Generation Networks

Conclusions

Next Generation Wireless Emerging Market Opportunities

Next Generation Wireless: Emerging Market Opportunities

Scott Chase

PowerPoint Slides

www.strategisgroup.com

The worldwide wireless industry is in the midst of a fundamental shift from a dominant voice- to a data-centric focus. Voice will remain "the" killer application for the foreseeable future. However, wireless data currently is receiving more attention. For many wireless carriers and infrastructure vendors, the demand for wireless data now outweighs the cost of overcoming various hindrances of the past. Operational 2.5G digital network infrastructure will substantially increase the speed and reliability of data transmission. The deployment of this infrastructure will unleash an array of advanced applications and services, paving the way for 3G technologies.

Large U.S. carriers plan to launch their 2.5G packet networks in 2001. The migration to next generation networks will be gradual. Network operators will overlay their voice networks with data capabilities in a step-by-step migration. The United States must take several strides in order to catch up with rest of the mobile data-enabled world. Both the Japanese and European markets have substantial head starts. Simply put, U.S. mobile data network growth has been slowed by a non-ubiquitous data network, incompatible standards, lack of compelling data applications, awkward user interfaces, high service charges, and difficulties with spectrum allocation. The race toward 3G high-speed data networks and the applications offered on these networks should be considered a marathon rather than a sprint.

With the AT&T Wireless announcement that it would implement GSM/GPRS during 2001 comes a push to converge the air interface protocols in the U.S. The use of TDMA networks is expected to decline while CDMA and GSM networks become the dominant air interfaces operators use for data applications. As networks become faster, capacity improves, and application developers standardize markup languages (i.e., WAP, HDML, cHTML, xHTML, etc), demand will improve for wireless data applications. Device manufacturers must work alongside application developers, operators, and network infrastructure vendors in order to deliver devices that are compatible not only with network applications, but also with the needs and desires of consumers.

Ubiquitous availability in nations and regions as well as competitively priced and compelling applications — and not necessarily network speeds — will drive mobile data growth in all global markets.

Next Generation Wireless
Emerging Market Opportunities

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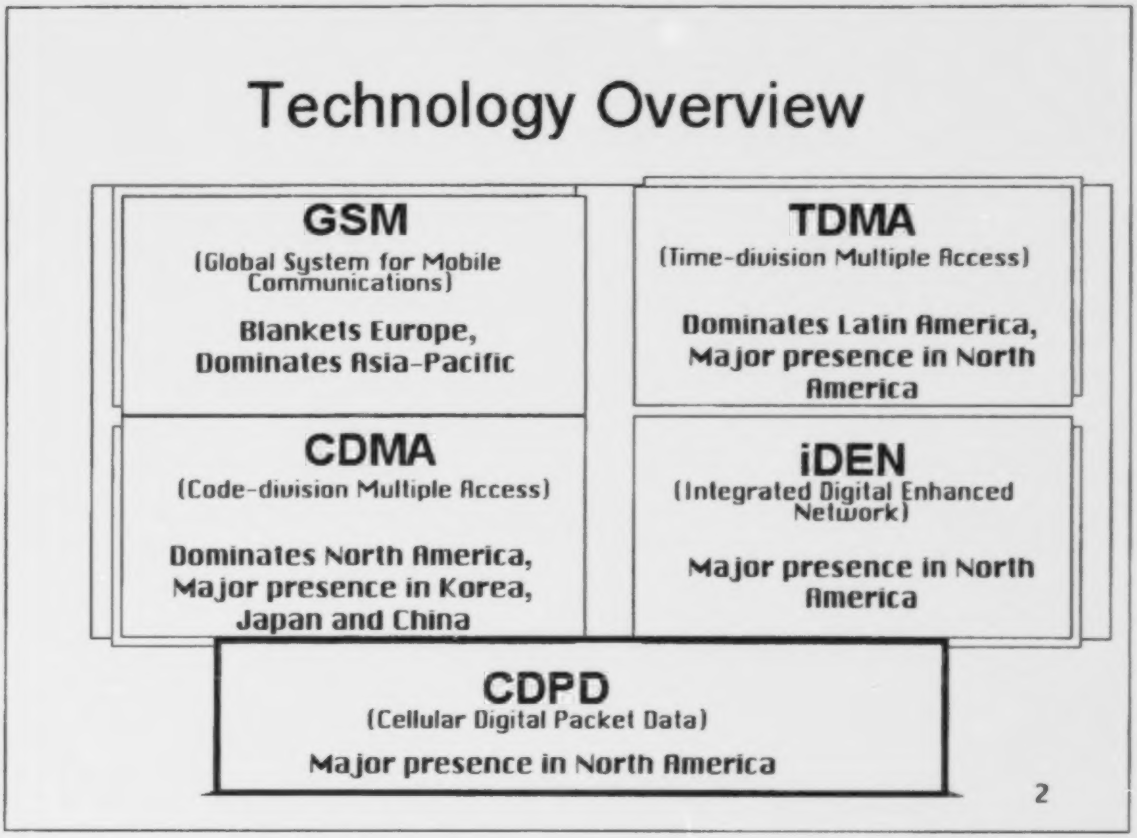

Technology Overview

GSM

(Global System for Mobile Communications)

Blankets Europe, Dominates Asia-Pacific

TDMA

(Time-division Multiple Access)

Dominates Latin America, Major presence in North America

CDMA

(Code-division Multiple Access)

Dominates North America, Major presence in Korea, Japan and China

iDEN

(Integrated Digital Enhanced Network)

Major presence in North America

CDPD

(Cellular Digital Packet Data)

Major presence in North America

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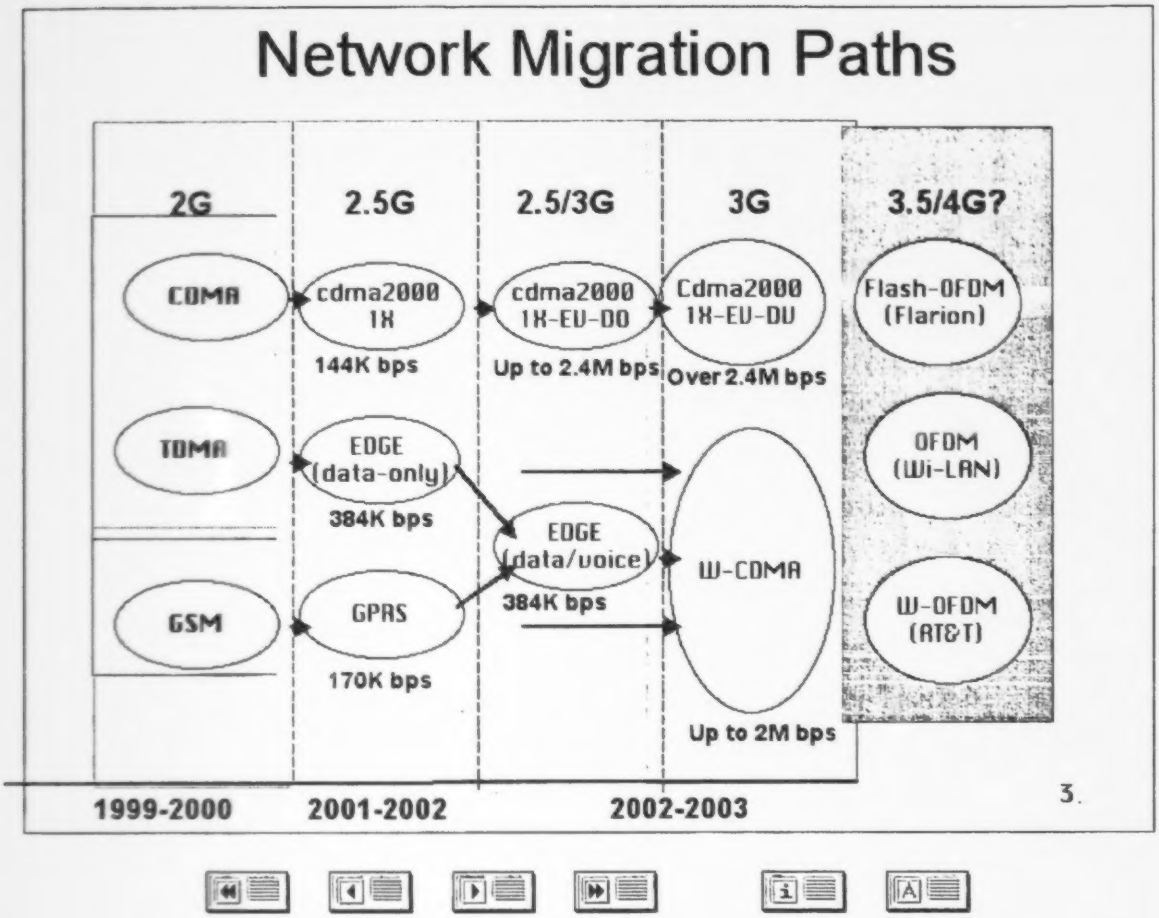

Network Migration Paths

2G | 2.5G | 2.5/3G | 3G | 3.5/4G?

CDMA → cdma2000 1X (144K bps) → cdma2000 1X-EV-DO (Up to 2.4M bps) → Cdma2000 1X-EV-DV (Over 2.4M bps)

TDMA → EDGE (data-only) (384K bps) → EDGE (data/voice) (384K bps) → W-CDMA (Up to 2M bps)

GSM → GPRS (170K bps) → EDGE (data/voice) → W-CDMA

Flash-OFDM (Flarion)

OFDM (Wi-LAN)

W-OFDM (AT&T)

1999-2000 | 2001-2002 | 2002-2003

Slide 3 of 25

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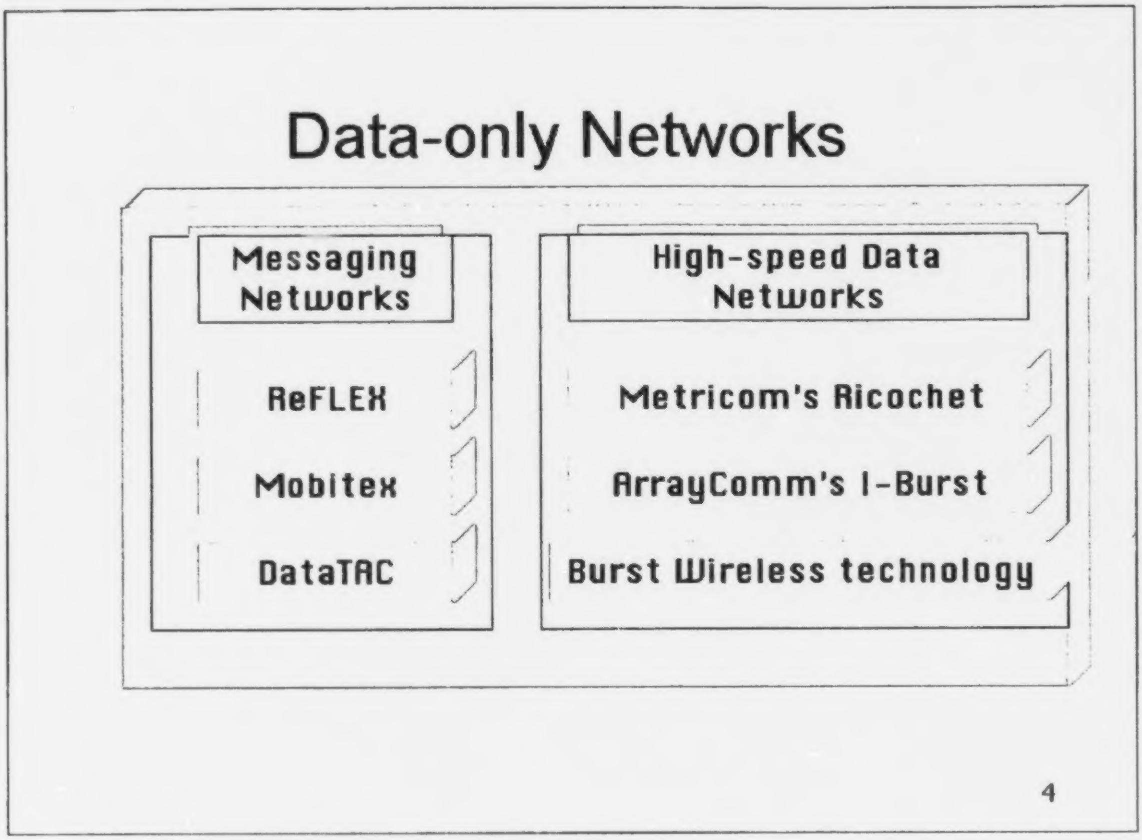

Data-only Networks

Messaging Networks

- ReFLEX
- Mobitex
- DataTAC

High-speed Data Networks

- Metricom's Ricochet
- ArrayComm's I-Burst
- Burst Wireless technology

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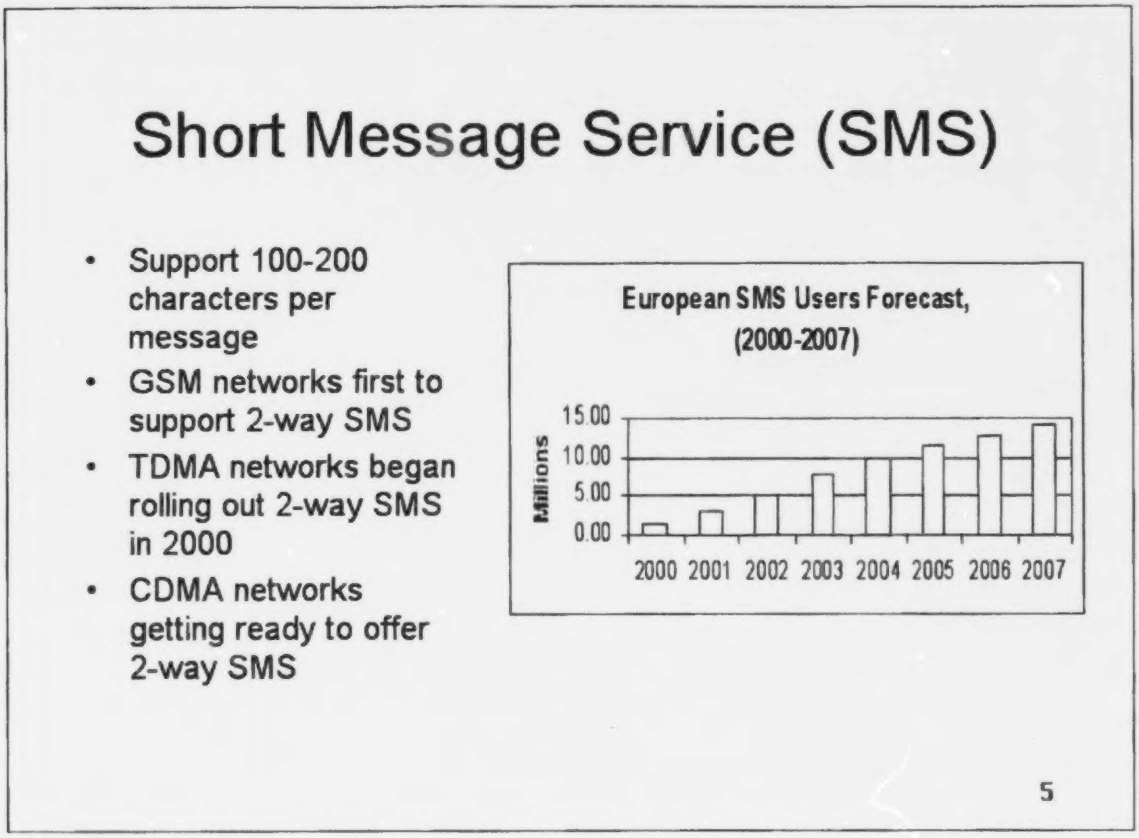
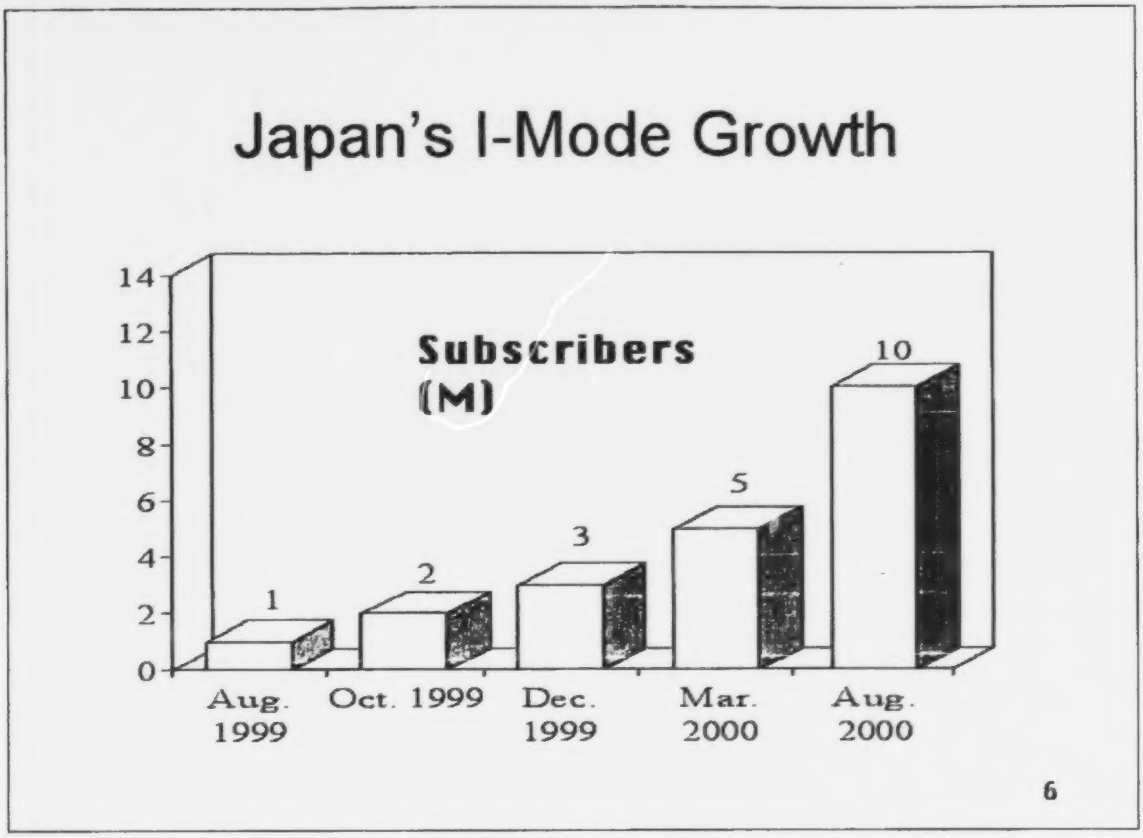


Short Message Service (SMS)

- Support 100-200 characters per message
- GSM networks first to support 2-way SMS
- TDMA networks began rolling out 2-way SMS in 2000
- CDMA networks getting ready to offer 2-way SMS

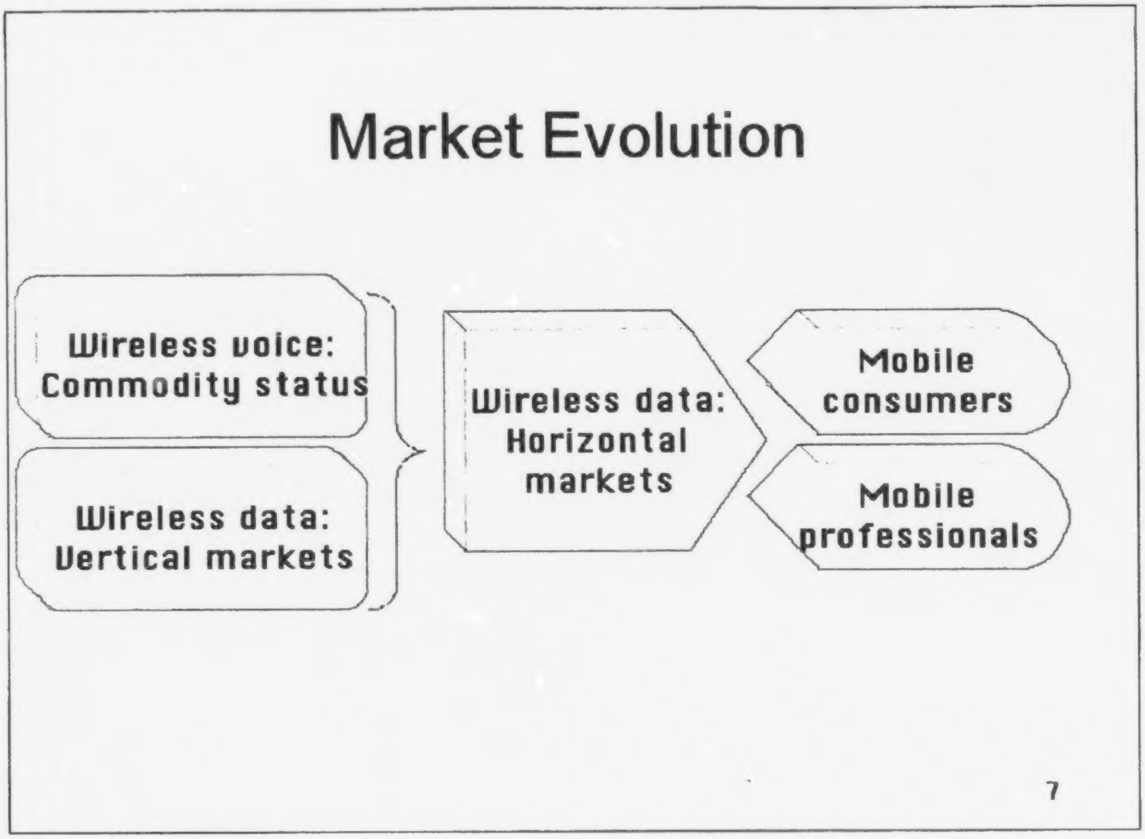
European SMS Users Forecast, (2000-2007)

Millions
15.00
10.00
5.00
0.00
2000
2001
2002
2003
2004
2005
2006
2007



Japan's I-Mode Growth

Slide 6 of 25



Market Evolution

Wireless voice: Commodity status

Wireless data: Vertical markets

Wireless data: Horizontal markets

Mobile consumers

Mobile professionals

Slide 7 of 25

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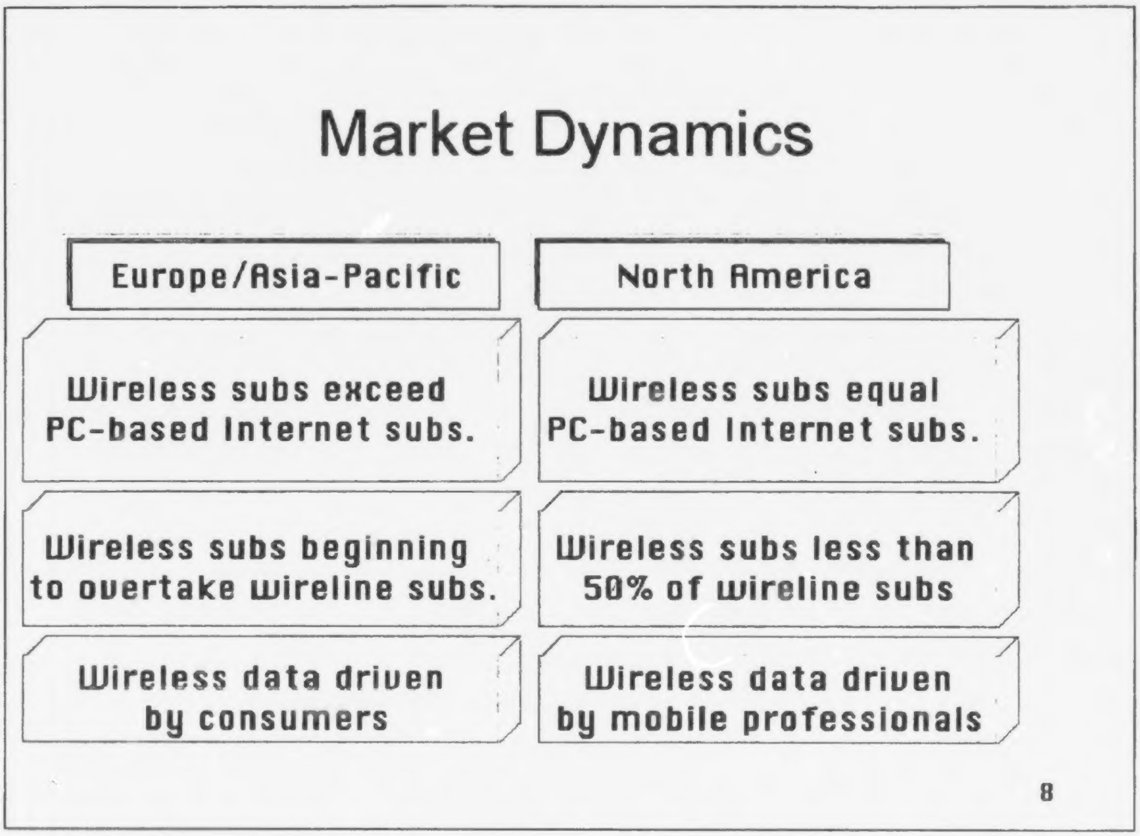

Market Dynamics

Europe/Asia-Pacific	North America
Wireless subs exceed PC-based Internet subs.	Wireless subs equal PC-based Internet subs.
Wireless subs beginning to overtake wireline subs.	Wireless subs less than 50% of wireline subs
Wireless data driven by consumers	Wireless data driven by mobile professionals

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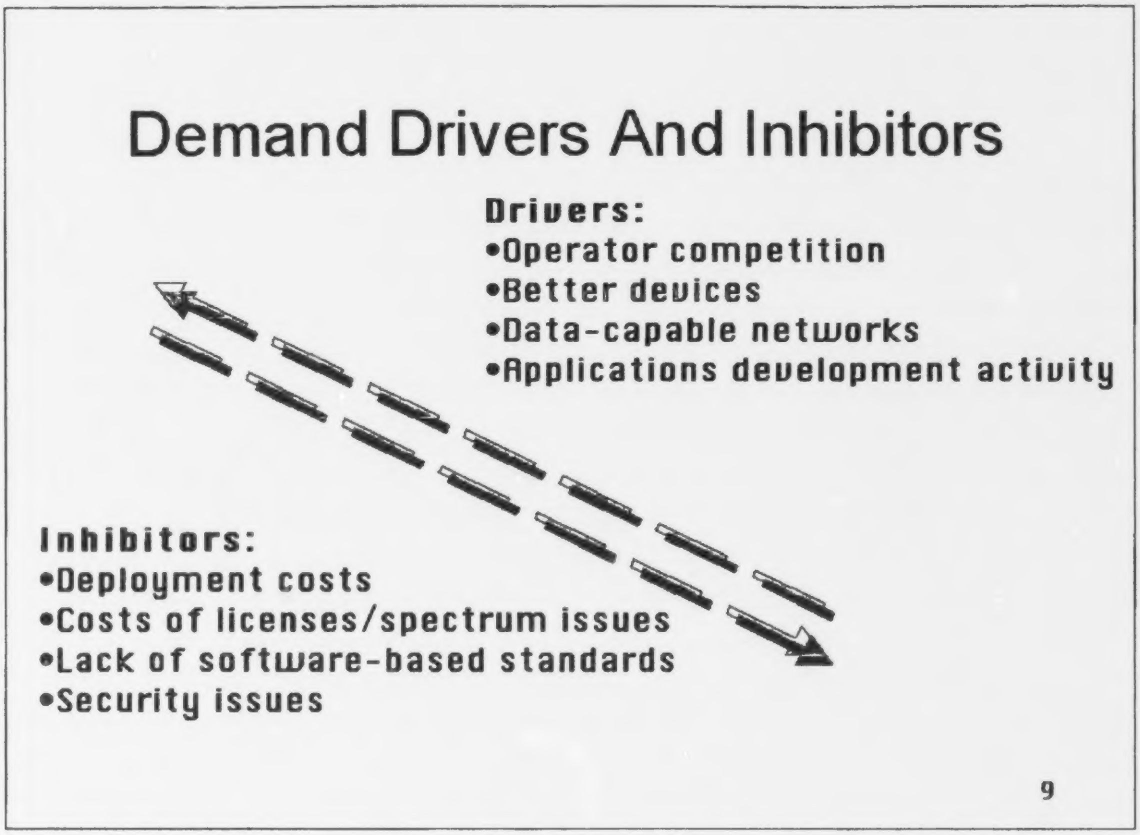


Demand Drivers And Inhibitors

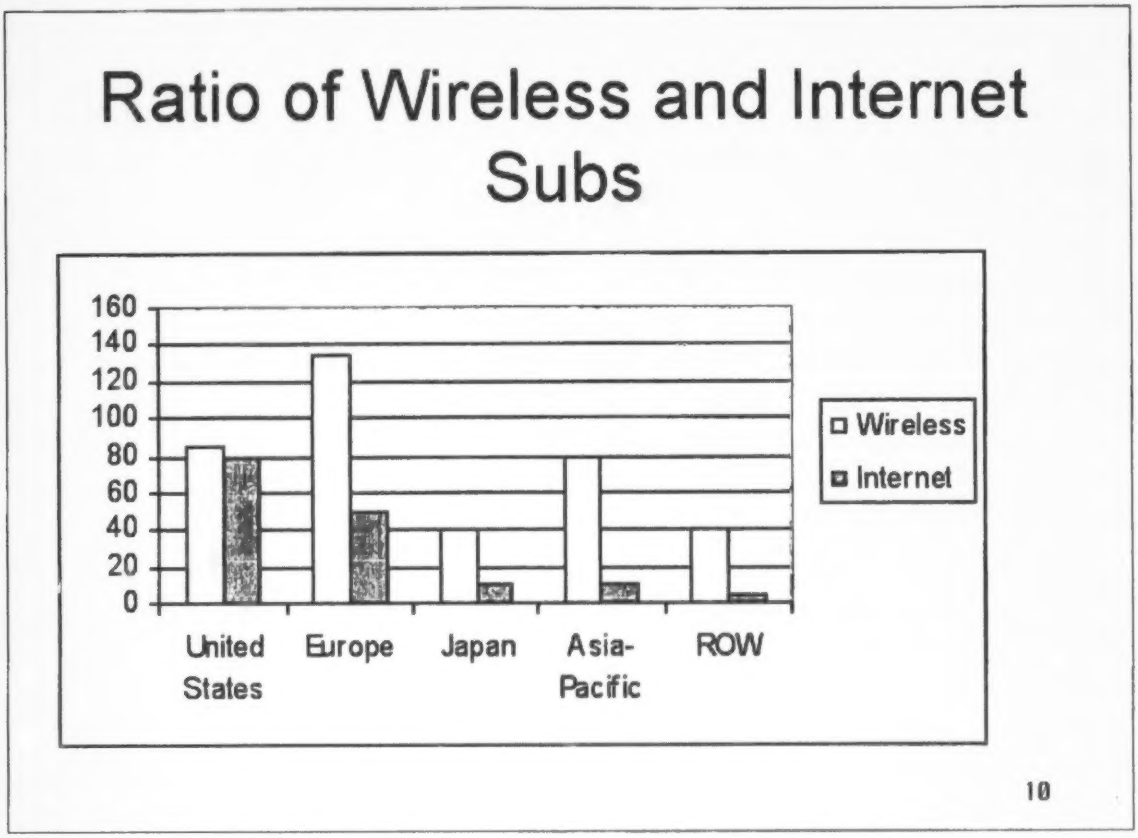
Drivers:

- Operator competition
- Better devices
- Data-capable networks
- Applications development activity

Inhibitors:

- Deployment costs
- Costs of licenses/spectrum issues
- Lack of software-based standards
- Security issues

Slide 9 of 25



Ratio of Wireless and Internet Subs

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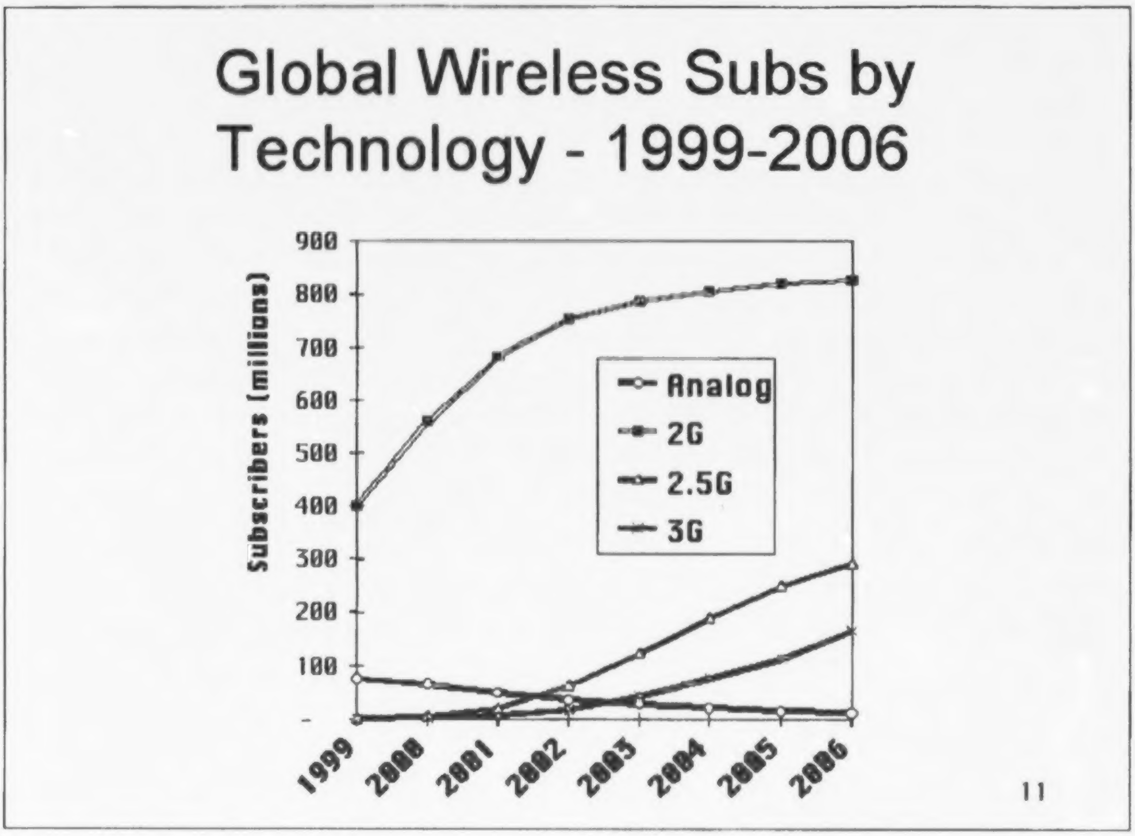
Slide 10 of 25



Global Wireless Subs by Technology - 1999-2006

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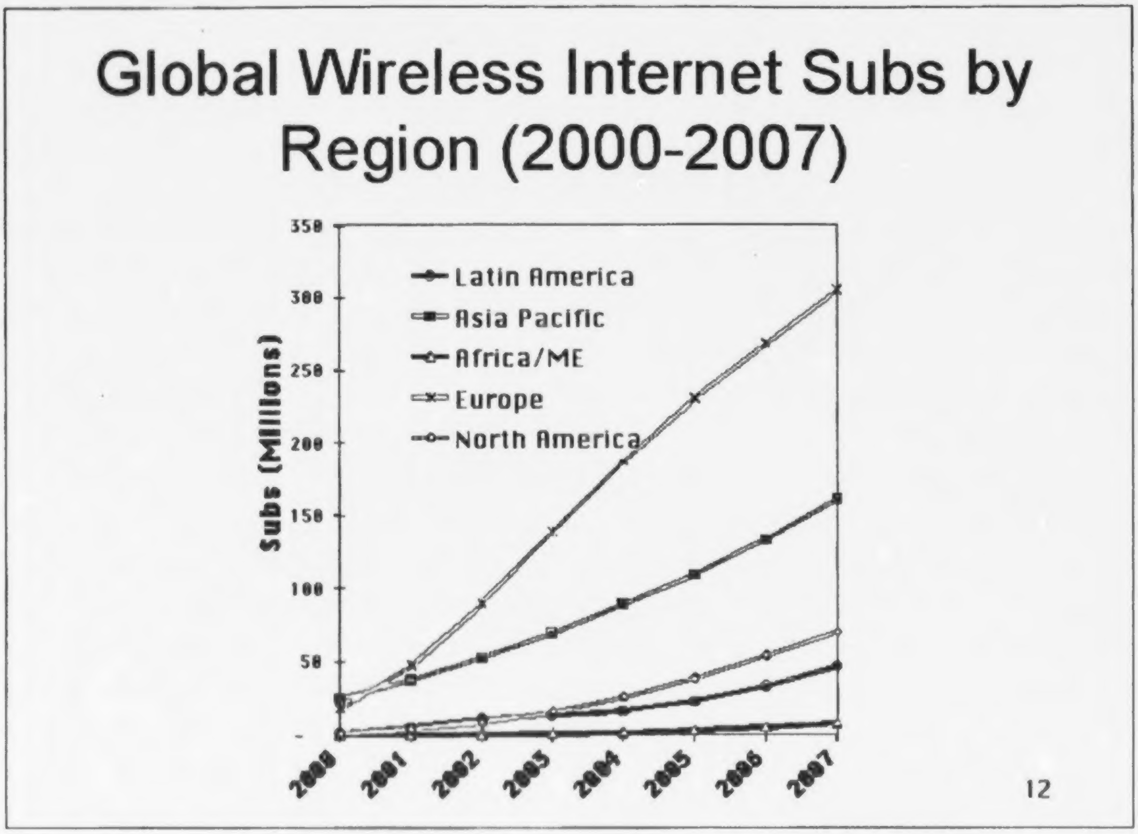
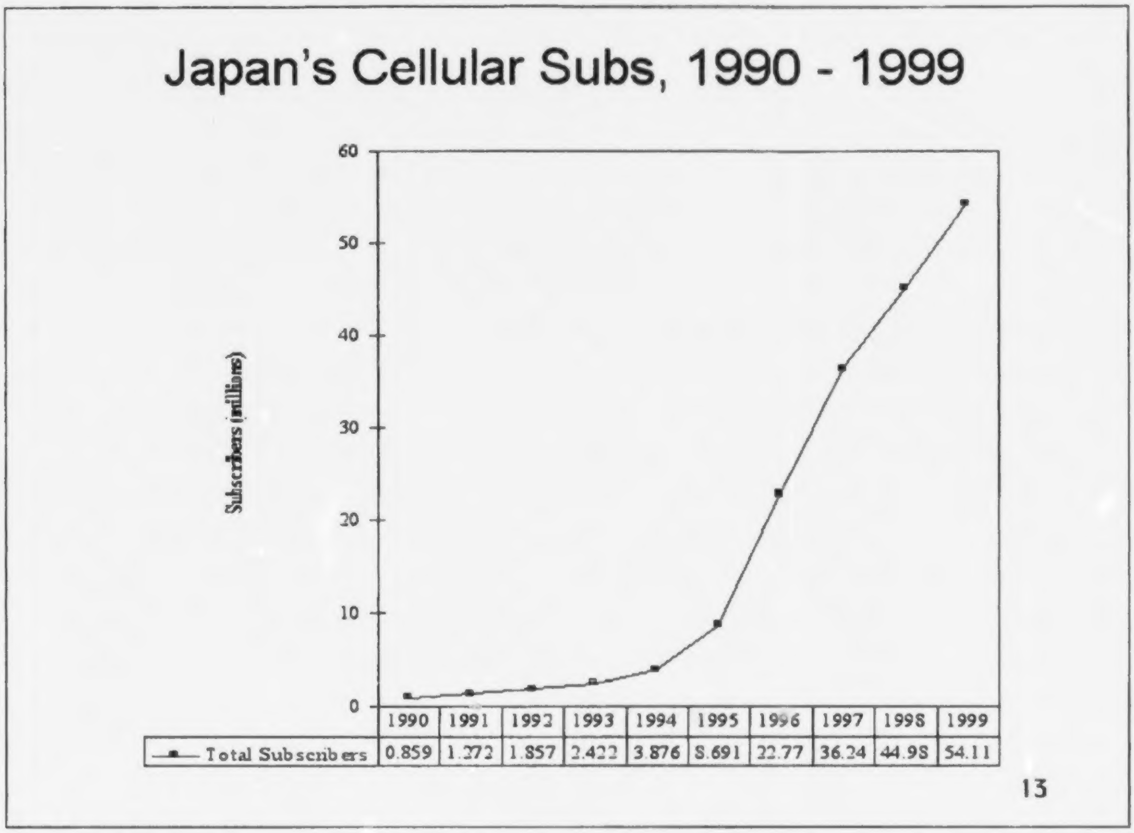


Global Wireless Internet Subs by Region (2000-2007)

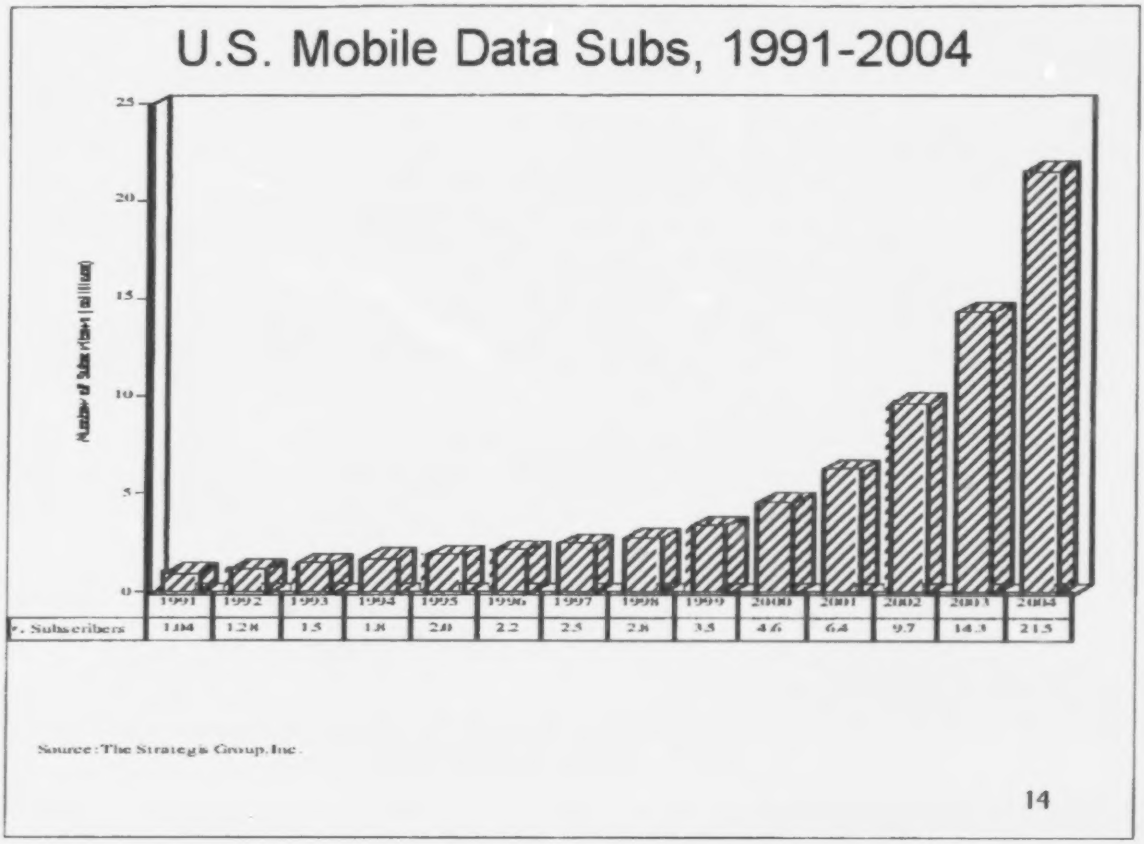
12

Slide 12 of 25



Japan's Cellular Subs, 1990 - 1999

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total Subscribers	0.859	1.272	1.857	2.422	3.876	8.691	22.77	36.24	44.98	54.11



U.S. Mobile Data Subs, 1991-2004

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Subscribers	1.04	1.28	1.5	1.8	2.0	2.2	2.5	2.8	3.5	4.6	6.4	9.7	14.3	21.5

Source: The Strategis Group, Inc.

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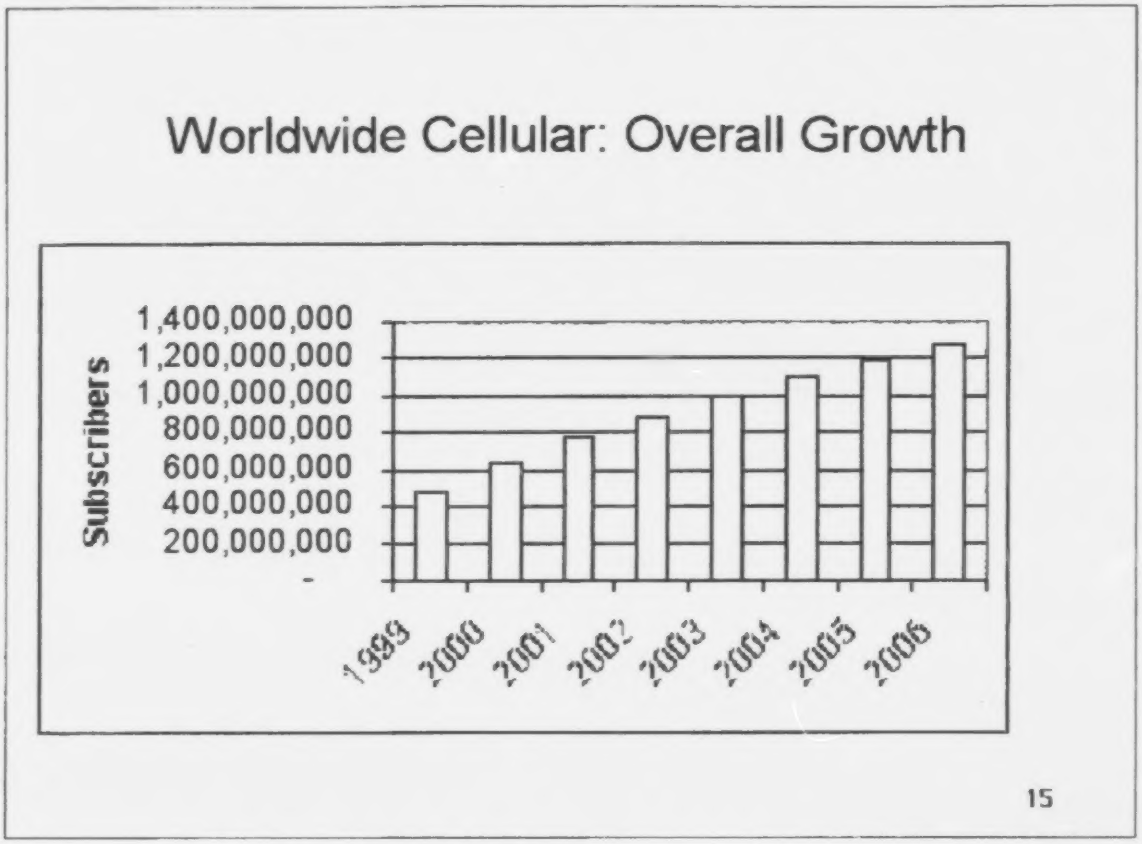
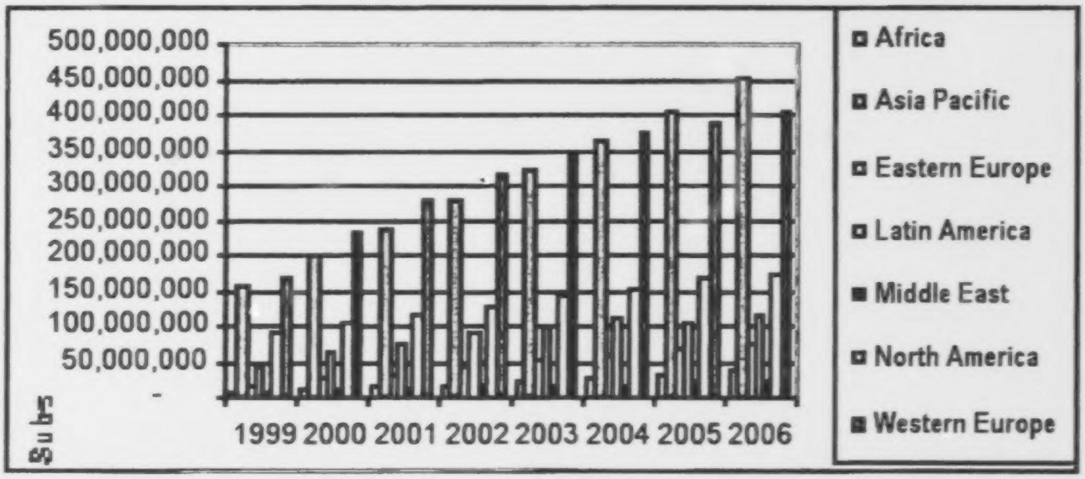
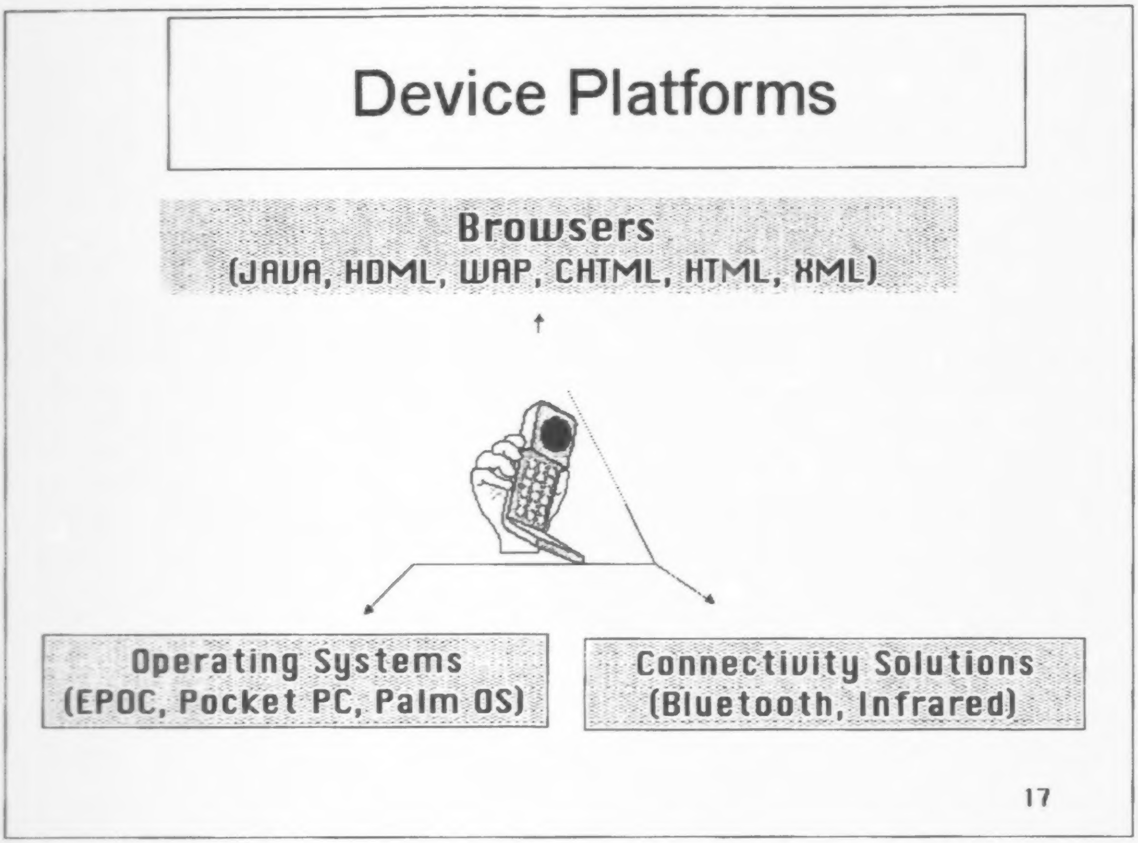


Worldwide Cellular: Overall Growth

Slide 15 of 25

Worldwide Cellular: Subs by Regions



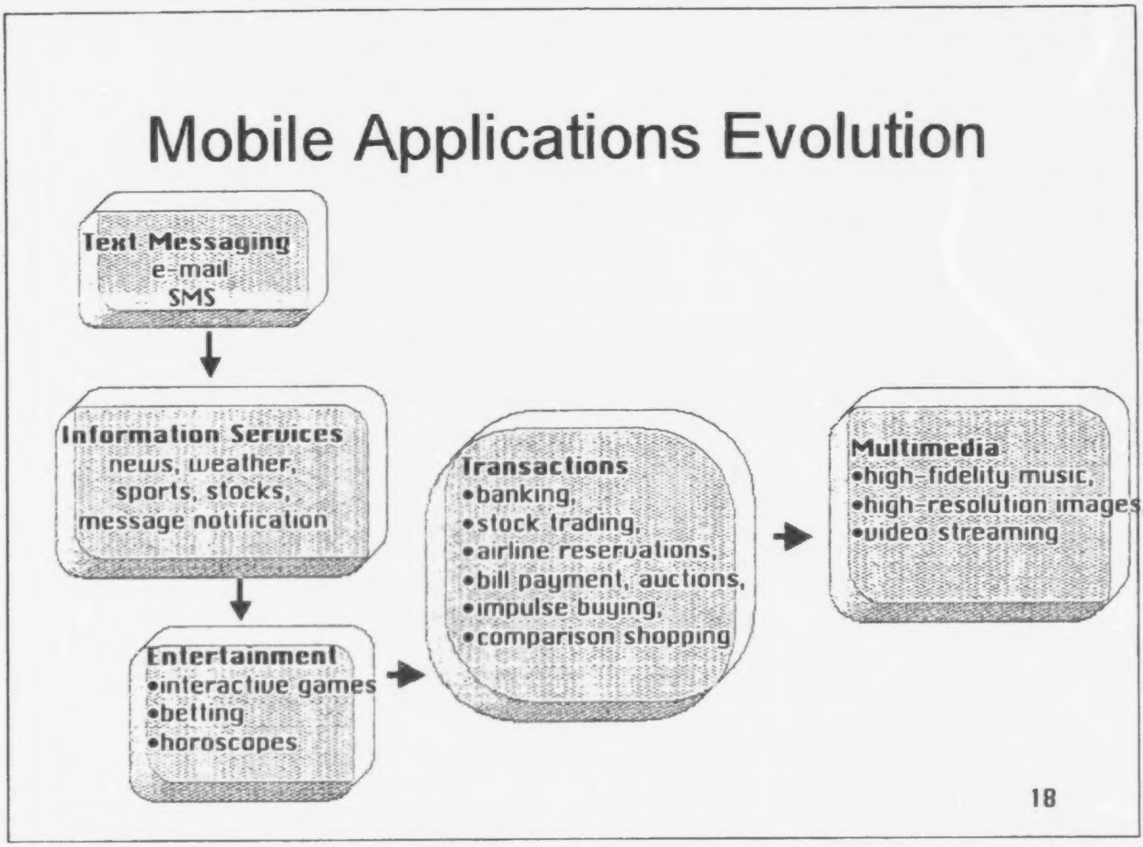


Device Platforms

Browsers
(JAVA, HDML, WAP, CHTML, HTML, XML)

Operating Systems
(EPOC, Pocket PC, Palm OS)

Connectivity Solutions
(Bluetooth, Infrared)



Mobile Applications Evolution

Text Messaging
e-mail
SMS

Information Services
news, weather,
sports, stocks,
message notification

Entertainment
- interactive games
- betting
- horoscopes

Transactions
- banking,
- stock trading,
- airline reservations,
- bill payment, auctions,
- impulse buying,
- comparison shopping

Multimedia
- high-fidelity music,
- high-resolution images,
- video streaming

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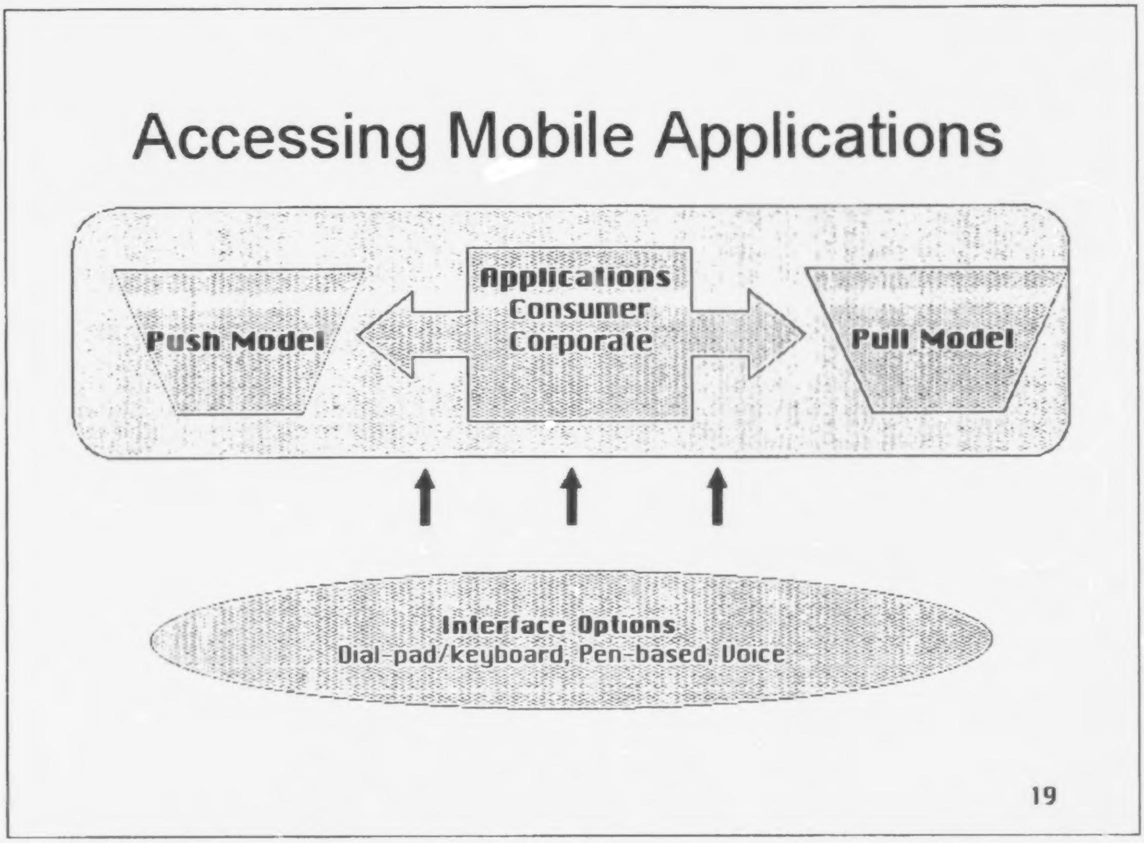

Accessing Mobile Applications

Push Model

Applications
Consumer
Corporate

Pull Model

Interface Options
Dial-pad/keyboard, Pen-based, Voice

Slide 19 of 25

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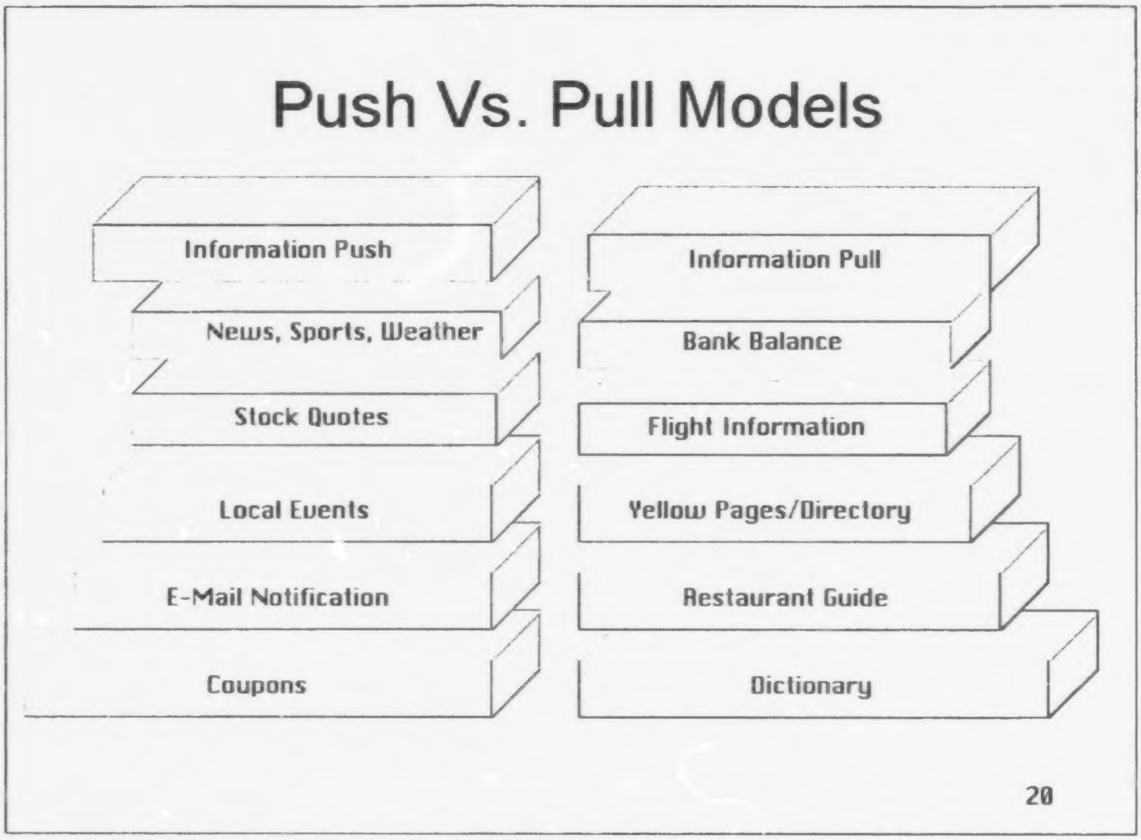

Push Vs. Pull Models

Information Push

- News, Sports, Weather
- Stock Quotes
- Local Events
- E-Mail Notification
- Coupons

Information Pull

- Bank Balance
- Flight Information
- Yellow Pages/Directory
- Restaurant Guide
- Dictionary

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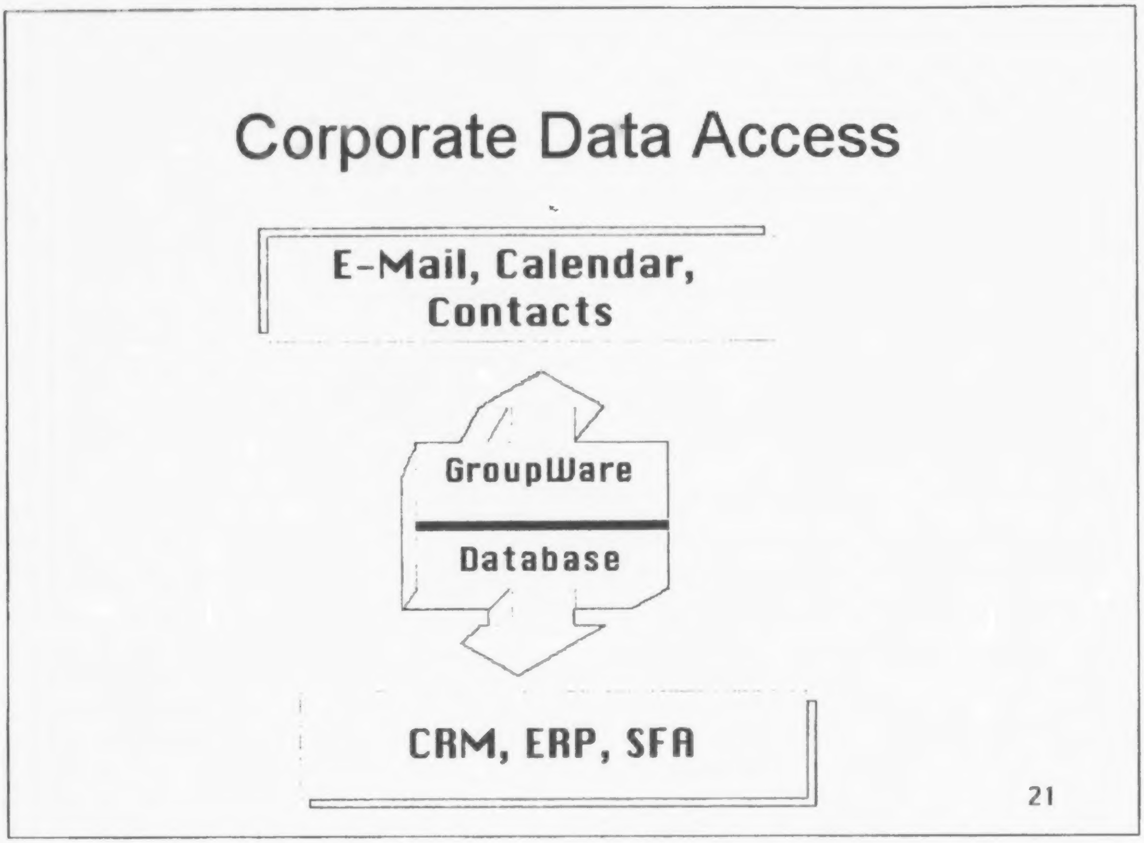

Corporate Data Access

E-Mail, Calendar, Contacts

GroupWare

Database

CRM, ERP, SFA

Slide 21 of 25

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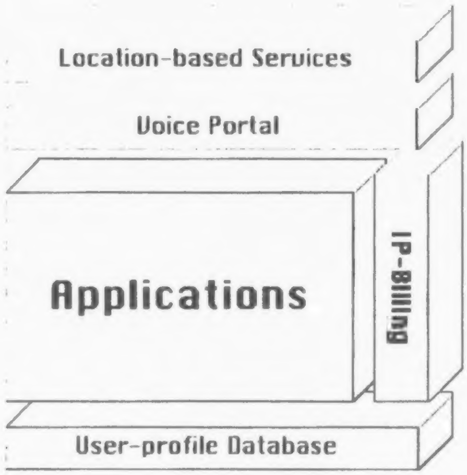
Enabling Mobile Data Applications



Location-based Services

Voice Portal

Applications

IP-Billing

User-profile Database

Slide 22 of 25

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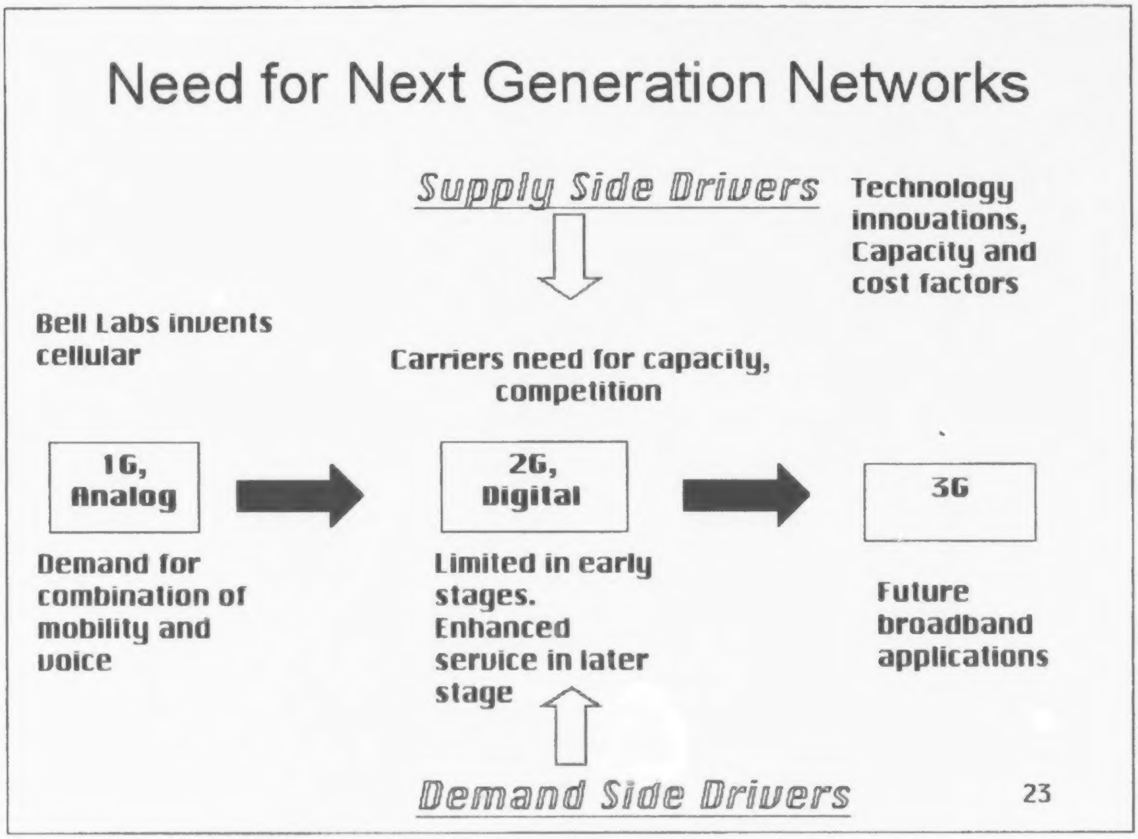


Need for Next Generation Networks

Supply Side Drivers

Technology innovations, Capacity and cost factors

Bell Labs invents cellular

Carriers need for capacity, competition

1G, Analog → **2G, Digital** → **3G**

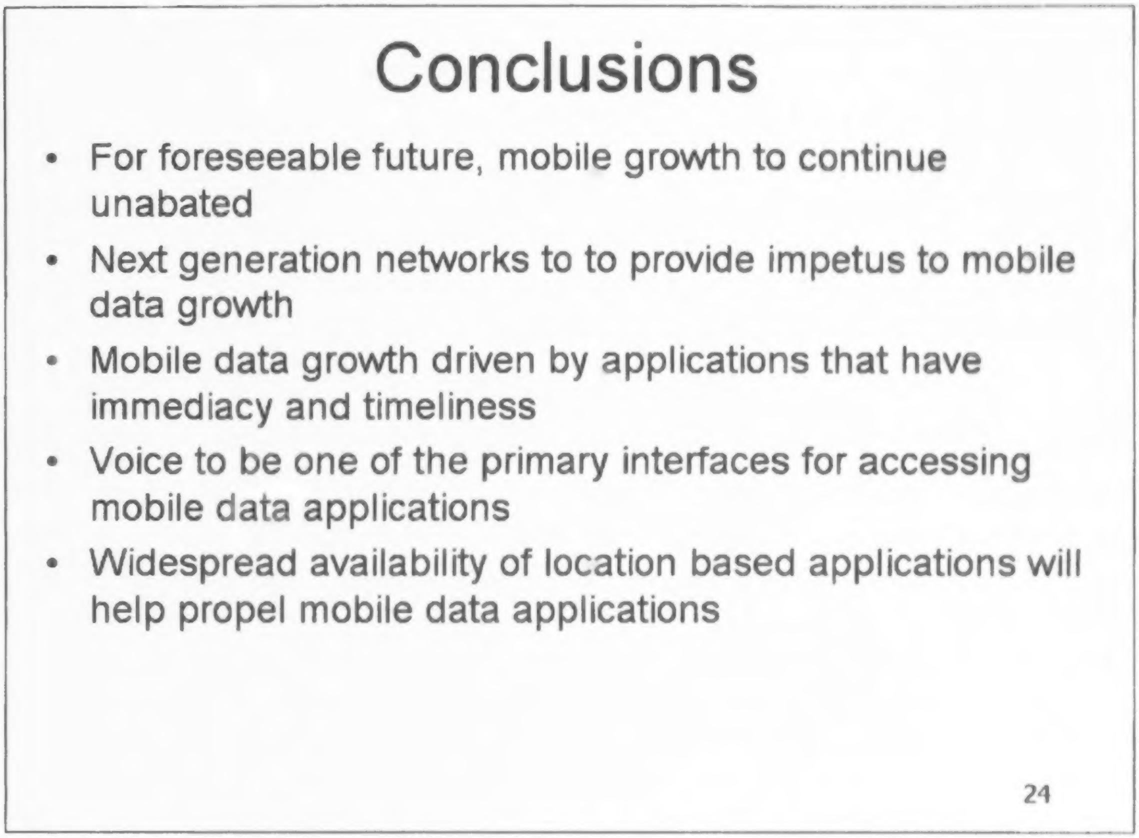
Demand for combination of mobility and voice

Limited in early stages. Enhanced service in later stage

Future broadband applications

Demand Side Drivers

Slide 23 of 25



Conclusions

- For foreseeable future, mobile growth to continue unabated
- Next generation networks to to provide impetus to mobile data growth
- Mobile data growth driven by applications that have immediacy and timeliness
- Voice to be one of the primary interfaces for accessing mobile data applications
- Widespread availability of location based applications will help propel mobile data applications

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⏮ ◀ ▶ ⏭ ℹ A

Scott Chase

Scott Chase is the president and chief executive officer of The Strategis Group, a leading telecommunications industry market research and consulting firm located in Washington, D.C., with offices in London, Singapore and Sao Paulo. He previously had been senior vice president and group publisher of the Satellite and Space Group of Phillips Business Information, Inc., Potomac, MD.

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Back to proceeding page   Back to the sessions page

Efficiency Improvement of Channel Element Utilization Through a New Radio Access Network (RAN) Architecture of IMT-2000 System.

Chang-Yeun One, Hyung-Rock Park, and Whan-Woo Kim

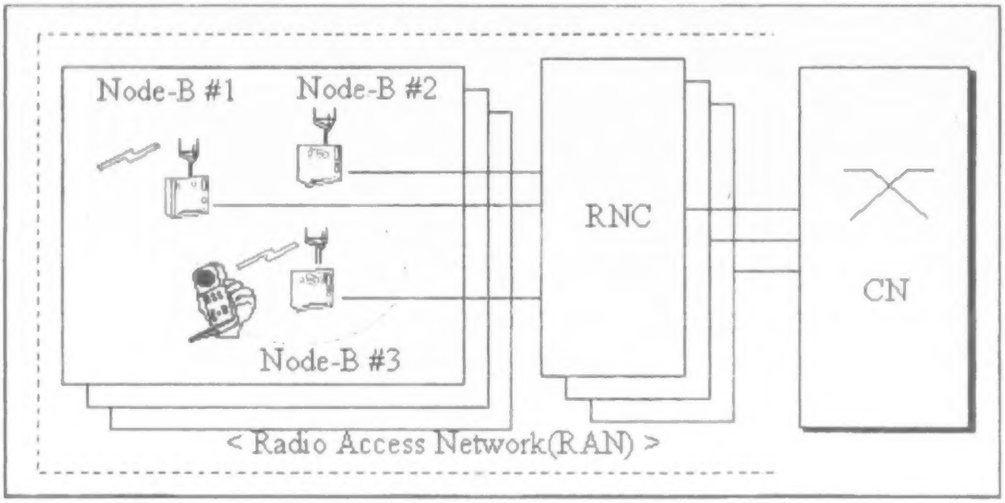
Abstract

www.sktelecom.com

1. INTRODUCTION

Most of mobile communication systems consist of three parts, which are Node-B(namely base transceiver system), radio network controller(RNC), and core network(CN) in Fig. 1. The RNC and CN systems are located in the same site, and operated, maintained by operators. On the other hand, The Node-B is installed in the most optimized site by cell coverage, distribution of call volumes and the quality of voice, and sometimes it is relocated or increased by volumes of call traffics. And it is operated without operators. A Node-B has many component units. The most important elements are channel card(CHC) composed of channel elements(CE), which process data streams of voice. When subscriber tries to make a call with a mobile terminal(MT), A CE is assigned to the MT to process voice data. The number of CEs in a Node-B is determined by volumes of subscriber and call traffic in the cell coverage of Node-B. The structures of Node-B can be separated into 3 units, which are radio frequency(RF)/analog processing unit, digital processing unit and Node-B controlling unit. And each unit has several modules. In some case RF/analog processing unit can be separated from Node-B to make small Node-B, and other units can be moved to RNC belonged to the Node-B. The RNC with digital processing unit and Node-B controlling unit is very efficient. As channel element resources can be flexibly allocated to a call requested by subscriber regardless of Node-B, and then it is possible to increase the efficiency of channel element utilization.

Based on the analysis of the current structures and functions of mobile communication system, this paper proposes a new mobile system architecture improved efficiency of channel elements utilization by allocating flexibly the resource pool named 'channel bank' independent on Node-Bs. Now I will focus on the advantages and defects of proposed structure and the improvement method of utilization efficiency from channel bank structure.

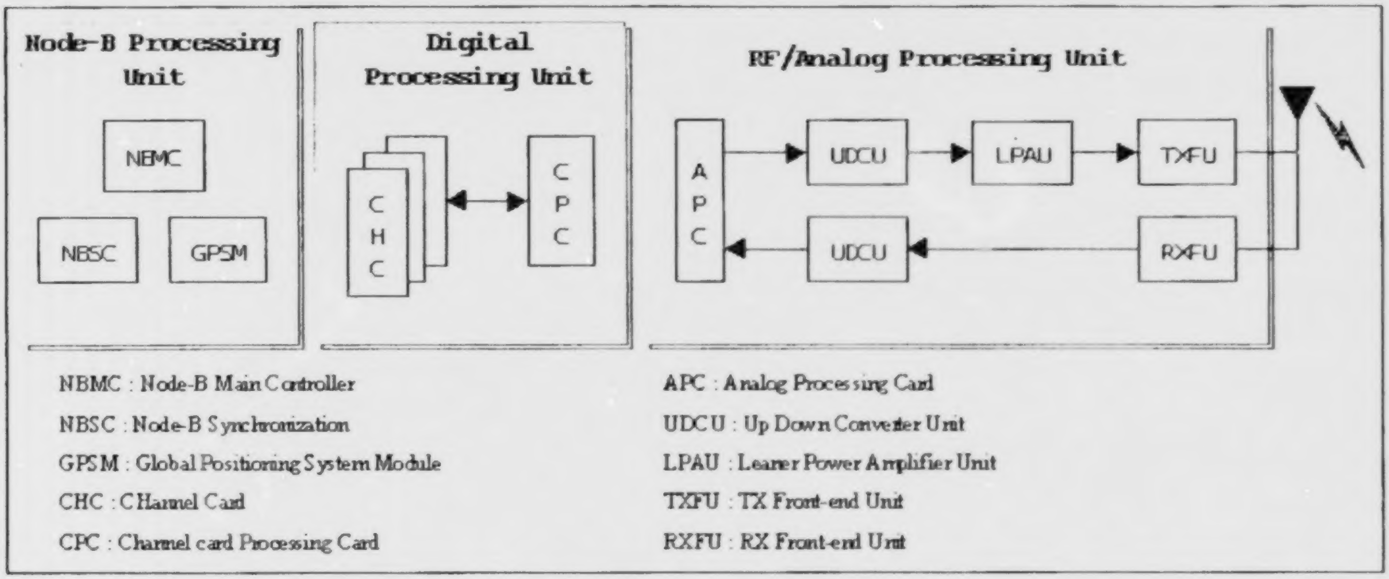


[Figure 1] Mobile communication system structure.

2. THE STRUCTURE OF MOBILE COMMUNICATION SYSTEM AND CE EFFICIENCY

2.1 Node-B structure and functions

The general Node-B consists of three parts, which are RF/analog processing Unit, digital processing unit and Node-B controlling unit in Fig. 2. The RF/analog processing unit transmits and receives voice data and signaling data streams to MT through wireless link such as code division multiple access(CDMA). The digital processing unit has a channel element processing card(CPC) and a large number of channel cards(CHC). A CHC is a set of many important channel element(CE) resources which modulate and demodulate voice data. The Node-B controlling unit controls entire Node-B and then sets up or releases from calls.



NBMC : Node-B Main Controller
NBSC : Node-B Synchronization
GPSM : Global Positioning System Module
CHC : CHannel Card
CPC : Channel card Processing Card
APC : Analog Processing Card
UDCU : Up Down Converter Unit
LPAU : Leaner Power Amplifier Unit
TXFU : TX Front-end Unit
RXFU : RX Front-end Unit

[Figure 2] Node-B structure.

2.2 radio network controller(RNC) structure and functions

The universal RNC consists of four parts, which are asynchronous transfer mode(ATM) switch unit(ASU), Node-B interface unit(NIU), RNC main control unit(RMU) and diversity hand-over unit(DHU) in Fig. 3. The ASU is routing signaling and traffic data streams between Node-B and core network including inner RNC. The NIU is linking RNC to Node-Bs and core network with physical T1, E1, STM1 links. The RMU takes the responsibility of set up and release from mobile originating/terminating calls by processing signaling messages between Node-Bs and core network. Additionally RMU performs system operation and maintenance(O&M). The DHU consists of many transcoders and processes encoding/decoding traffic date frames. On the other hand, transcoders are located in core network according to 3rd generation partnership project(3GPP) technical specifications.

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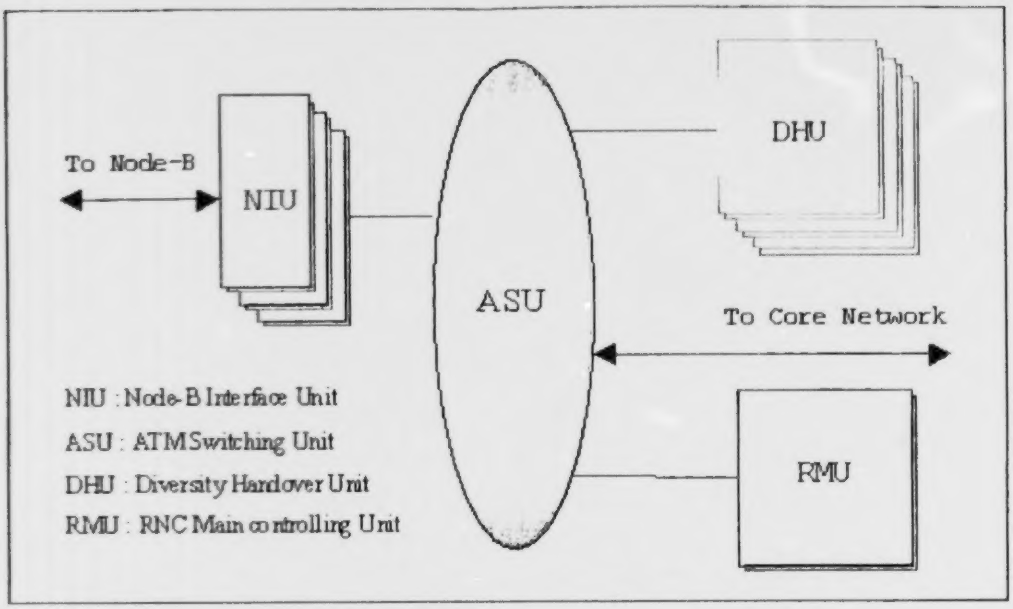
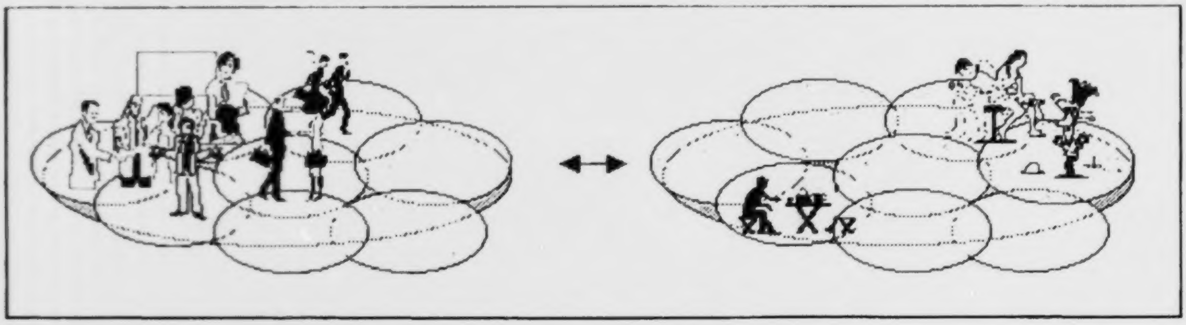

To Node-B
NIU
ASU
DHU
To Core Network
RMU
NIU : Node-B Interface Unit
ASU : ATM Switching Unit
DHU : Diversity Handover Unit
RMU : RNC Main controlling Unit

[Figure 3] RNC structure.

2.3 The analysis of the efficiency of channel elements utilization

In many resources of Node-B in the mobile telecommunication system, particularly channel elements are important call resources dependent of Node-B. When a mobile terminal(MT) tries to make a call in a Node-B, One channel element is assigned to a MT for call service. And when a MT moves neighbor Node-B in a conversation state(it is called hand-over situation), some channel elements in several Node-Bs are simultaneously allocated to a MT.

According to hourly statistic datum of call volumes from 01:00 to 24:00, there is a 'busy hour' during a day. It is called when the maximum amounts of call service requirement are occurred for an hour. And it means a period of time from 6:00 pm to 7:00 pm in the most cases. At that time, it is mainly happened the simultaneous allocations of the channel elements. It means that the Node-B should have enough channel elements to satisfy the call service requirements which are occurred during the busy hour. There is the important fact that the volumes of call occurrence are different by the hour during a day, because subscribers geographically tend to move sites according to their life patterns(it is called mobility inclination of the subscribers). For example, service users are usually concentrated in office areas in working time and they move to residential areas or the shopping districts after work in Fig. 4. By reason of mobility inclination of the subscribers, the efficiency of CE utilization in a Node-B is changed during a day. It is also changed between weekday and weekend. Consequently, when busy hour, the Node-B can be changed to overloaded state or disabled state due to the lack of CE resources. And most of CE resources are keeping idle state during a day except busy hour.



[Figure 4] mobility inclination of the subscribers.

The table.1 shows the call statistic datum which are obtained by two Node-Bs in different areas. In truth, Node-B #1 is located at an industrial complex and the Node-B #2 is located at the park district. Total call attempts mean sum of MT originating, terminating and hand-over calls by subscribers in a Node-B. And they are collected during busy hour. Analyzing call statistic data of table 1, for example, Node-B #1 has 356 CEs for call resources, and 33584 call attempts are occurred during busy hour of some weekday. The efficiency of CE utilization(CE usage) is 50.4% at that time, and it is highest value during a day. On the other hand, Node-B #1 shows that the number of call attempts is decreased about 60% for busy hour of weekend compared with weekday, because it is located at the industrial complex. Node-B #2 shows the opposite situation that the number of call attempts is increased about 6% in weekend compared with weekday. From the datum, we can see that the efficiency of CE utilization is changed at busy hour of weekday and weekend by the mobility inclination of the service users.

Items	The number of CEs	Total call attempts in busy hour	Average holding time of CE per a call service(Sec)	CE usage (%)	Remarks
Node-B #1	356	33584	64	50.4	Weekday
		13719	58	18.2	Weekend
Node-B #2	219	2861	54	10.9	Weekday
		3034	46	11.4	Weekend

[Table 1] Call statistics in some Node-B's.

3. COMPACT NODE-B AND CENTRALIZED RNC SYSTEM STRUCTURE

3.1 compact Node-B

It is possible to separate the digital processing unit and Node-B controlling unit from current Node-B structure of Fig. 2. And then we can reorganize the Node-B to have only RF/analog processing unit(It is called compact Node-B) in Fig. 5. The separated parts from current Node-B, the digital processing part and Node-B controlling unit, can be included in RNC system. And especially the channel element(CE) resources from a number of Node-Bs are able to gather into resource pools named "Channel Bank". Even though all Node-B controlling units are included in RNC system, they are not needed as many as the number of Node-B. Only one Node-B controlling unit in RNC can perform monitoring function, diagnosis/report function, resource management and resource assignment function of channel bank.

Interface method between RNC including channel bank and compact Node-B can be used wave length division multiplexing(WDM) way with optical cables which have broad bandwidth and are little affected by noise. So compact Node-B should have electro-optic converter to interface with RNC. And also every sector of Node-B should have electro-optic converter as well as RF/analog processing unit. As compared with normal Node-B, compact Node-B can be easily installed, relocated, increased in the most optimized regions. Especially a great advantage of channel bank in RNC is that channel elements are not subordinate to a specific Node-B. From this a merit, we can reduce the number of channel elements in comparison with the total sum of the resources in normal Node-Bs, as efficiency of the resources utilization are always maintained high. Also, we have advantages in management and operation of channel element resources by channel bank.

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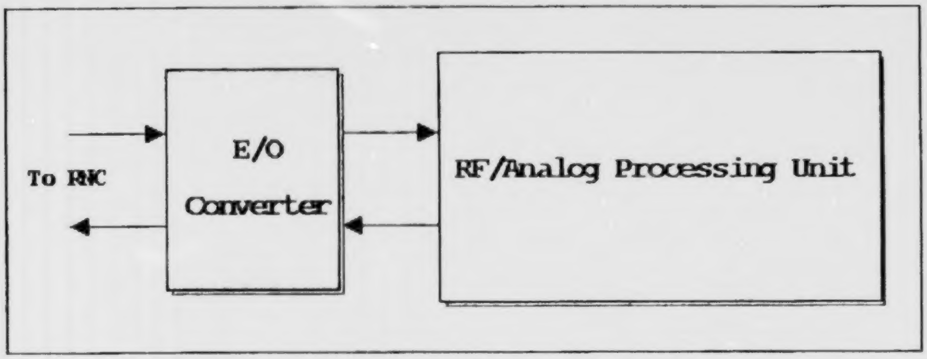
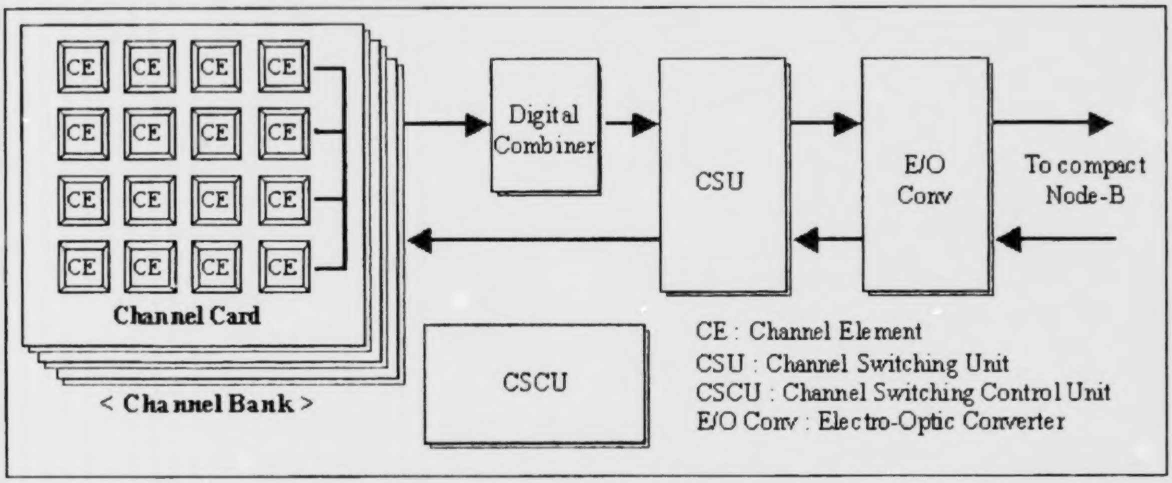

To RNC
E/O
Converter
RF/Analog Processing Unit

[Figure 5] architecture of compact Node-B.

3.2 RNC with channel bank(named 'centralized RNC')

3.2.1 RNC modification by compact Node-B

From the Fig. 6, digital processing units included in RNC are made up of channel bank composed channel elements. And there are needed electro-optic converter, channel switching unit(CSU) and channel switching control unit (CSCU) too. The CSU performs dynamically to switch channel element data stream path between compact Node-Bs and centralized RNC. And CSCU is integrated with each Node-B controlling unit, manages and allocates channel elements in CSU and controls CSU to connect an allocated CE to corresponding compact Node-B for each call service request.


CE
Channel Card
< Channel Bank >
Digital Combiner
CSU
E/O Conv
To compact Node-B
CSCU
CE : Channel Element
CSU : Channel Switching Unit
CSCU : Channel Switching Control Unit
E/O Conv : Electro-Optic Converter

[Figure 6] resource pool structure in RNC.

3.2.2 Allocation method of channel element resources in channel bank

From the Fig. 7, channel bank structure consists of channel cards(CHC) which is set of channel elements. It is possible to allocate dynamically CE resources for call service requests to any compact Node-Bs by controlling of CSCU.

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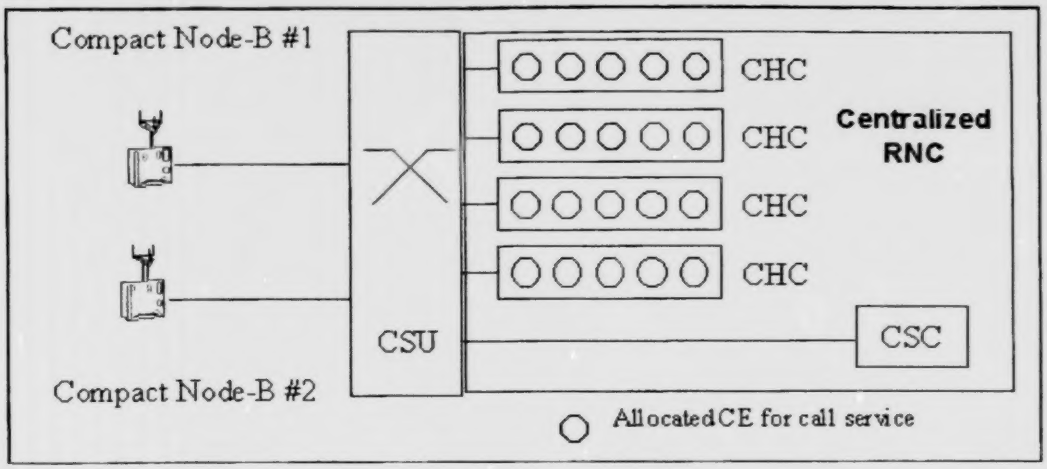
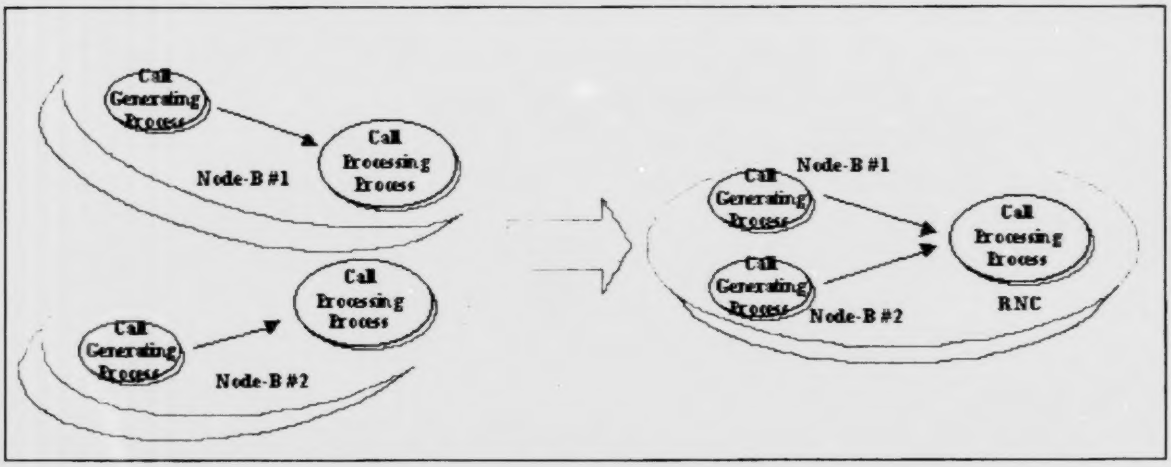

Compact Node-B #1
CHC
CHC
CHC
CHC
Centralized RNC
CSU
CSC
Compact Node-B #2
○ Allocated CE for call service

[Figure 7] resource pool structure.

When a call service request comes in, CSCU always searches for one CE of idle state in channel bank sequentially and assigns a selected CE to requested call. It is called 'Sequential Allocation' in this paper. From this structure and method, we can efficiently manage and utilize CE resources regardless of mobility inclination of the subscribers and it may be prevent undergoing the call-disabled state because of shortage of CE resources in busy hour.

3.2.3 Simulation Results of proposed structure

Now, these simulations will show advantage of efficiency of CE utilization in proposed system architectures composed of compact Node-B and centralized RNC. From Fig. 8, simulators are composed of two processes - the 'call generating process', which makes and sends calls like as mobile terminals and the 'call processing process', which receives calls, allocates CEs and gathers the related call statistic datum. Using call attempts of statistic data in Table 1, Simulations will be performed with two methods. One way is that two call generating processes make and send calls to each Node-B #1, 2 for an hour. And then call processing process in each Node-B counts the number of needed CEs after processing all calls and measures efficiency of CE utilization(CE usage) for simulating normal Node-B and RNC structure as left side of Fig. 8. The other is that call generating processes of Node-B #1 and Node-B #2 simultaneously make and send calls to centralized RNC. And a 'call processing process' acts the same processes in proposed channel bank structure as right of Fig. 8. And the algorithm to allocate CE resource is used sequential allocation in both of simulation methods.


Call Generating Process
Call Processing Process
Node-B #1
Call Processing Process
Call Generating Process
Node-B #2
Node-B #1
Call Generating Process
Call Processing Process
Call Generating Process
Node-B #2
RNC

[Figure 8] simulation of CE resource allocation.

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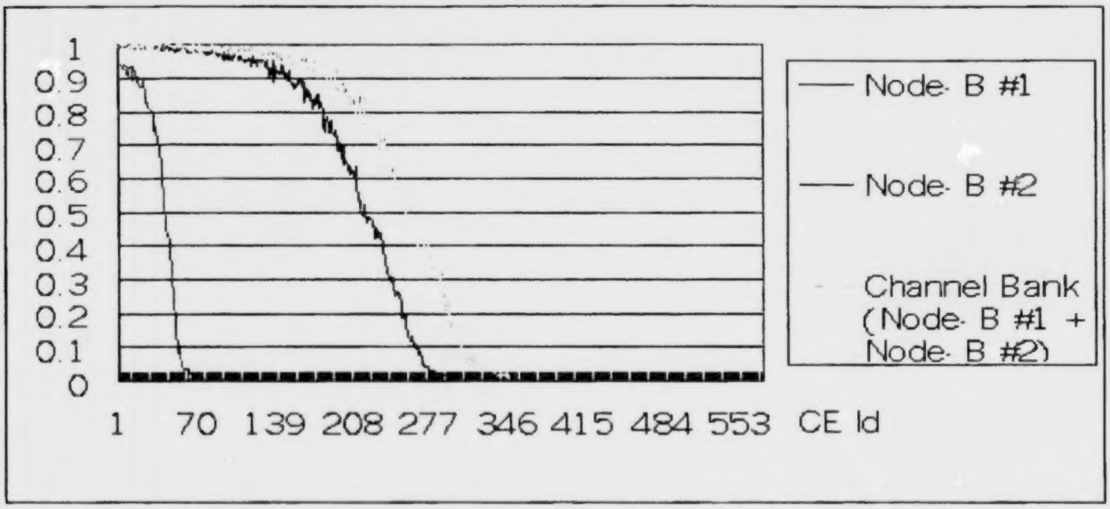
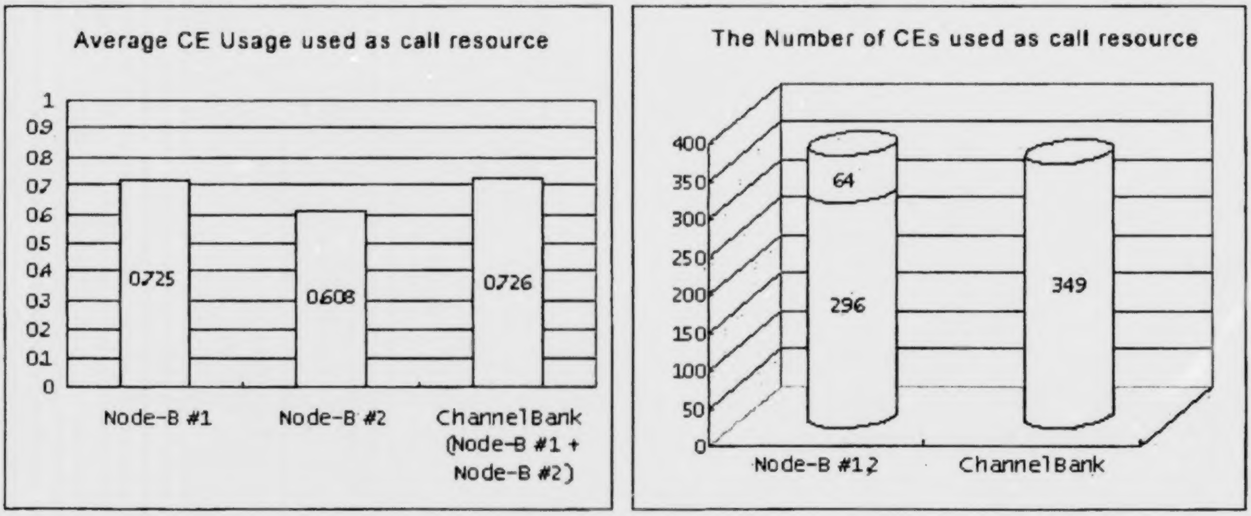
The Fig. 9 shows simulation results of CE usage. This means that first CE of resource table in channel bank is the highest usage approaching 100% efficiency of utilization. And as CE identification increase, CE usage decreases.



[Figure 9] CE usage used as call resource.

From Table 1, they are 356 and 219 for the number of channel elements which are dependent on each Node-B #1 and Node-B #2 in the normal Node-B structure. After simulations of first method, the number of channel elements used call resources are 296 and 64 in each Node-B from Fig. 9 and 10. And the average holding ratio of CEs allocated to call resources are 72.5% and 60.8% for Node-B #1 and 2. On the other hand, CE resources can be allocated as channel bank in right side of Figure 8. Then the number of CE resources is needed 349. So we can see that 11 CE resources is reduced in channel bank architecture and the average holding ratio of allocated CE resources is also increased to 72.6% That is, efficiency of CE utilization is increased and then the number of CE resources are decreased in proposal system architecture.



[Figure 10] The number of CEs and CE usage used as call resource.

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4. CONCLUSION

In this paper, I proposed the compact Node-B with RF/analog processing separated from normal Node-B Unit and centralized RNC included with channel bank of channel element resource pool. From the proposed architecture, we can obtain several advantages. When installing compact Node-Bs and centralized RNCs for mobile communication systems, we are able to reduce cost to build up and operate easily the systems. This technique can be applied to IMT-2000 system, because it needs more Pico-cell type Node-B than 2nd generation system.

In the proposed system structure, it is influenced by capability of channel switching unit(CSU). If capability of CSU is low, it is impossible to control whole Node-Bs dependent on a RNC. In these cases, the multistage design of CSU or grouping only several Node-Bs per a CSU can be the solution for the problem. And to increase the efficiency of channel bank utilization in proposed system architecture, it is needs of Node-B grouping which is different from volumes of call service requirement in the same time, and it is also necessary to analysis fully of statistic datum in 2nd generation Node-Bs.

This paper is only the beginning of research on mobile communication system architecture and allocation method of call resources to enhance efficiency of call resources utilization. Especially we have to check further into the matters such as reality of CSU hardware structure, optic interface method, the structure of channel bank and inner channel card(CHC), and any problems which can not be figured above.

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Back to top of page **Back to the sessions page**

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Back to proceeding page   **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

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Back to proceeding page **Back to the sessions page**

Bringing IP to Mobile: The Network Revolution of Internet and Wireless Convergence

Bo Hedfors

Abstract

Crossroads and Convergence - the Internet and Wireless

The Internet is unprecedented in its impact upon the world community - industries, institutions, and individuals. It has touched most all of our lives in how we communicate, how we promote our products, how we teach our children, and how we invest our time.

The growth of Internet-based traffic on wireline networks has exploded, doubling every three months on major long distance connections. Many carriers now report that over half the traffic they carry is data (via fixed lines). This dramatic rise in data communications traffic can be attributed mostly to the rise in popularity of the Internet.

The shift to Internet Protocol (IP)-based transport, IP-based computing and IP-based media is driving the convergence of the computer, telecommunications, and media industries. This convergence has the power to transform how we live, work, and play. At the crossroads of this convergence lies another opportunity-the opportunity to bring the power and potential of IP to wireless. Wireless operators worldwide are beginning to implement the first stages of next generation technology with General Packet Radio Service (GPRS) and are deploying the technology to serve as a learning tool on the road to 3G.

The time for wireless data is now, as cell phones have hit the mass market, and the Internet has created an open global standard. Until now, the growth of wireless and the Internet has occurred on two parallel paths. Soon these paths will merge into a wireless Internet, representing the greatest inflection point in the history of communications. For users everywhere, the wireless Internet will mean immediate access to information without restrictions of time or location. And for network operators and service providers, it offers a huge array of attractive new business opportunities with new revenue streams.

Soon the wireless Internet will become prevalent around the world. Over the last year, industry projections for the number of wireless Internet subscribers have changed dramatically. The initial forecast for reaching one billion users by 2005 has been revised to 2003, and some experts are even predicting the industry may see one billion users by 2002! It is also expected that by 2003, more subscribers could be accessing the Internet over mobile networks than over fixed ones.

Several key parameters will drive this accelerated consumer demand for wireless Internet:

- Internet penetration and maturity
- Wireless phone penetration and maturity
- The shift to increasing ***both*** tele-density and Internet-density

We are entering an era that will merge wireline and wireless, voice and data, and multi-media services. It's the wireless IP future, and it's becoming a reality today.

The Peer-to-Peer Network Vision

This vision of a wireless IP future can become a reality only with an IP-based communications architecture that will serve as the foundation for an end-to-end solutions portfolio of networks, access devices, and applications. An IP-based network will enable true peer-to-peer wireless communication and client/server operation for wireless network operators.

This communications architecture will have to be flexible, open, and standards-based, and must be capable of driving the standards for next generation networks, while also complying with existing standards. An IP-based communications architecture will facilitate a smooth migration from existing hierarchical, circuit-switched technology to peer-to-peer switched networks and will enable worldwide operators to create common network backbones. In addition, this architecture will also deliver superior cost and economic advantages to operators, providing added value through rapid deployment of new service offerings.

There are definite benefits to a broadband, IP-based, end-to-end networking solution:

Superior end-user experience

An IP-based approach enables the development and delivery of feature-rich, customized, and personalized end-user services and applications that are easy-to-use, ubiquitous, and available with speedy access. This new wireless Internet communications architecture will enable **personal networks** that fundamentally change the way people communicate. Consumers will be able to use one small device to order a plethora of services on demand-from videoconferencing to Web browsing, to e-commerce, address books, e-mail, voicemail, notes, and calendars. Instant self-provisioning will enable end-users to dial up and download the services needed - and use them within seconds, on a new generation of all-in-one handheld devices that can go anywhere.

Orderly migration

It is critical that operators be able to navigate the road to successful implementation of services at a pace that is right for them. This means that today's communications providers will have to bring into play integration skills that ensure a smooth migration to next-generation services-regardless of current technology-while leveraging an operator's current equipment investment. The new world architecture will enable ubiquitous services across any technology.

Rapid service delivery

A broadband, IP-based, end-to-end networking solution will open operators' systems to a world of new applications and services. The existence of an IP-based architecture and distributed client/server approach, coupled with open application programming interfaces (API's), will result in an improved ability to rapidly develop and implement new services and applications. Operators can enjoy competitive differentiation and build loyal customer relationships by being first to market with the newest voice, data, and multimedia services. As an added benefit, operators should be given the opportunity to work side-by-side with their communications provider in the development of operator-specific applications, ensuring not only rapid service delivery, but also services tailored made for a particular market.

Reduced cost of ownership

Another benefit of a packet-based, IP approach will be cost-effective, customized deployment. In addition, this approach has the potential to lower the total cost of network ownership by maximizing bandwidth efficiency, reducing network management costs, and offering maximum scalability.

Peer-to-Peer Networking Principles

If peer-to-peer networking is to be realized, any impediments to rapid development of easy-to-use applications will have to be eliminated. This means that the products associated with the wireless Internet communications architecture will utilize a common, carrier grade, off-the-shelf platform, composed of the appropriate hardware as well as cross-platform operating systems. The result will be a common, high availability platform that will provide new levels of service availability for wireless networks worldwide.

This platform will have an open applications programming interface (API), which means that the communications provider, the operator, or even a third party will be able to write to it, enabling rapid delivery of customized, highly reliable features and services. The communications architecture that makes this delivery possible is based on three key network elements, representing a comprehensive, end-to-end solution:

- Radio access network - Contains key functions that maintain the radio communication between the end-user and the communications infrastructure.
- Core network - Provides the session and resource management needed to deliver services to end-users and additional networks.
- End-user services network - Delivers Internet and value-added services, applications, and content to consumers via user access devices.

Three key attributes emerge from this IP-based communications architecture:

- Separation of end user solutions and the wireless network - The network operator gains flexibility in deploying end user services and applications, independent of wireless switch manufacturers. This flexibility, combined with the advantages of open APIs, result in an expanded solution set, with faster and more economical deployment.
- Peer-to-peer, non-hierarchical communication and client/server operation - The network is based on a distributed model that offers the potential to realize significant gains in system performance, quality of service, capacity, and scalability. As a result, speed to market and cycle time can be significantly improved; operations costs can be reduced; and more intelligent operations, maintenance, and provisioning can be enabled across the network.
- Innovative technology enhancements - The network will include features like an inter-working function to optimize the bearer path and processing. This will ensure that the right resources are being assigned for optimal service delivery. An intelligent, IP-based transport layer will enable the interconnection between wireless and wireline networks, and IP and non-IP networks.

Migration to Next Generation Networking

One potential solution for migrating to next generation networks could be the use of a four-phased approach:

- Phase 1 - Basic packet data services

- Phase 2 - Enhanced data services and mobile VoIP
- Phase 3 - Integrated voice and data mobile IP networks
- Phase 4 - Multimedia peer-to-peer IP networking

Such a phased approach would put the operator in control, and while enabling the full potential of 3G, would also preserve the operator's investment in 2G equipment.

The first phase of orderly migration may offer a very non-invasive way for network operators to introduce packet data into their networks without interrupting voice service. In this phase, a small portion of data is siphoned off from voice and sent across "switch-less" packet IP-based networks. Basically, the packet data gets routed out of the traditional radio access network switch and into the IP- world. This enables basic data services. At this point in the evolution, almost all the traffic is voice - probably less than 5 percent is data.

At Phase 2 a services manager that knows how to set up a voice-over IP phone call could be added, along with a circuit gateway that could interact with the legacy circuit network. A feature server could be used to introduce a basic VOIP call. This approach would enable a "peaceful coexistence" between circuit and packet networks.

In Phase 3, adding 2.5G and 3G base stations to interface directly with the IP, peer-to-peer network could provide a full suite of integrated voice and data services. In addition, an RNCS could allow mobility in the packet, peer-to-peer space. As a result, only a small percentage of voice and data would be going through the circuit network.

Phase 4 may enable integrated voice and data services and applications such as Internet access on wireless devices. Dependency on legacy systems can be reduced. The new world communications architecture truly emerges, and integrated voice, data, and video become a reality.

Solutions for "Someone" - Customer Intimacy

In the new wireless world, the battle for market share will be fought at the end-user level; successful players will build value and lasting customer relationships on end-user services, applications, and integrated solutions. The convergence of the Internet and wireless will result in many new business opportunities, but the playing field and the rules of the game are changing rapidly. New players, new markets, and new services are all resulting in increased competition. End-user expectations are also increasing, so providing customers with cost-effective new services is a critical success factor. The future wireless world is an exciting one in which a total communications solution will enable new wireless services, applications, and revenue opportunities.

Potential new revenue opportunities may include applications such as:

- Personalized Content Access - personalized content tailored to meet end-user requirements will be important.
- Location Services - the value extends far beyond emergency services spanning from the individual, family, business, and beyond.
- Advertising - the use of preference and priority servers will allow operators to generate advertising revenue from third parties.
- Transaction Processing - the revenue opportunity for network operators that offer wireless transaction processing is tremendous.
- Monitor & Control - communications will expand to include not only people-to-people, but also people-to-machine and machine-to-machine through security monitoring, remote control access, and control of

common household appliances and business equipment.

The new wireless Internet model expands revenue opportunities into new terrain by enabling operators to grow data services revenue and capture revenue streams that were previously unavailable. While being first to market with superior new services, service differentiation, and innovation will be key to attracting and retaining customers, of equal importance will be the extent to which end users feel that these services meet their personal needs. This means that networks will need to be designed with individuals, not just customers "en masse," in mind.

Personal networks are networks designed for "someone"-not just anyone. Because individual preferences for services, information, and access devices vary, personal networking recognizes the individual and enables "tailored," personal networking solutions. An IP-based communications architecture, with its integration of voice and data, ease of use, performance, and mobility, enables such personal networking.

The communication provider of this architecture will need not only networking expertise, but also knowledge of end-user devices and consumer markets. This combination of knowledge and expertise will enable the communications provider to work closely with customers to identify, develop, and implement personal networks for "someone." The provider will possess insights based on in-depth, global interviews that seek to understand the end users, their preferences, how they use wireless services, and why they use these services. Based on this in-depth understanding of lifestyles, attitudes, preferences, and usage, communications providers will be able to work jointly with their customers to provide devices and service packages that deliver superior end-user services. The result will be and an assortment of new and innovative services available to the mobile wireless subscriber, services that contain a variety of distinct characteristics that enhance value to the end user.

Delivering the Wireless Internet

Developing successful commercial 3G systems with first-to-market speed requires depth of experience and expertise in complex systems implementation and integration. Additionally, in order to ensure a smooth and commercial system, other key capabilities such as Operation Support Systems (OSS), network management, and Operations and Maintenance (OA&M) are required. This means that operators-be they legacy operators looking to expand into next generation operations, Greenfield operators building their networks from the ground up, or mobile virtual network operators-will require not just solid technology, but also total, comprehensive solutions.

Tomorrow's IP-based networks beckon with opportunity for today's wireless operators and service providers, and the possibilities of this wireless Internet vision are endless. While the communications landscape is changing dramatically, shifting from a 2G voice-driven environment to the data-driven, applications-based 3G marketplace, the revenue opportunities for operators are endless as the new wireless Internet business model takes hold. If communications providers work with the right partners and develop the right plans, operators can start enjoying the benefits of orderly migration, faster speed to market with new services, superior end-user experiences, and reduced cost of ownership. The wireless Internet will then, indeed, become a reality.

Back to top of page   Back to the sessions page

Bo Hedfors

Executive Vice President, Motorola Inc.
President, Global Telecom Solutions Sector

Bo Hedfors is a Motorola Executive Vice President, and President of the corporation's Global Telecom Solutions Sector (GTSS).

GTSS is a multi-billion dollar business for Motorola, with more than 20,000 employees worldwide. In 1999, GTSS represented about 21 percent of Motorola's worldwide sales. GTSS serves more than 129 telecom carriers in 80 countries.

Under Bo's (pronounced "Boo") leadership, GTSS is driving Motorola's efforts to power the wireless Internet for telecom carrier customers worldwide.

By delivering the industry's first Internet protocol (IP)-based wireless networking solution, Motorola will combine voice, data and multimedia into one broadband IP network. As a result, consumers will be able to browse the Web, videoconference, and access rich streaming multimedia all from a single, wireless handheld device.

Under Bo's direction, Motorola has forged strategic alliances with some of the most respected names in the industry. Motorola's relationships with Cisco Systems Inc.; Sun Microsystems Inc.; Narus; Portal Software Incorporated; Xybridge Technologies; and others enable Motorola to tap into the best mix of innovation and creativity from leading edge companies. Together, Motorola and its alliance partners are leading the way in the convergence of wireless communication with the Internet, and providing a critical path to the commercial development and deployment of 3G mobile communications.

Bo currently leads Motorola's most critical business initiative: Winning Market Share in 3G (Third Generation) technologies. At stake over the next four years is more than $200 billion in 3G business opportunity including infrastructure, subscriber devices, and applications and services.

Before joining Motorola in September of 1998, Bo was president and chief executive officer of Ericsson, Inc. in Texas. He began his career at Ericsson in 1968 as an installation engineer.

In the 1970's, Bo began a succession of positions that allowed him to play a major role in developing telecommunications switch systems. He influenced software development, as well as new telecommunications switches, including Ericsson's highly successful AXE system, a program Bo eventually headed.

He held a series of management positions in Denmark and Sweden before moving to Anaheim, California, in 1983 as president of Honeywell-Ericsson, a joint venture in switch development.

Bo returned to Sweden in 1987 as director of technology for Ericsson's Computer Division. He became the corporation's chief technical officer in 1990. He returned to the US in 1994 to head Ericsson's US operations.

Bo is a member of the board of the Cellular Telephone Industry Association. He holds a Master of Science degree from Chalmers Institute of Technology in Sweden and is a member of the Royal Swedish Academy of Engineering Sciences.

Program

☑ **Policy / Regulatory**

Wednesday, 17 January 2001
0830–1000

W.1.5 The Global Regulation of Mobile Satellite Systems: The Users' Plight, The Need For Truly Open Access and The Lessons To Be Learned

Location: Honolulu Suite

Chair: WILLIAM K. COULTER, Partner, Telecommunications & Technology, Coudert Brothers, *USA*

The Millennium Year 2000 brought not only the much awaited introduction of Mobile Satellite Services (MSS) to many quarters of the Pacific, but also the just as prompt demise of several of the most promising Mobile Satellite Systems. What now lays in store for these Systems and Services? What caused the convergence and emergence? Clearly, a number of lessons have been learned, or have they? This panel of satellite regulatory="/certs will examine the MSS regulatory landscape in the major markets and will attempt to draw some conclusions that will help users and new applicants to better understand the role that Market Access and Regulatory Barriers play in the offering of any new service. The lessons they uncovered will have a startling impact on new entrants into almost every field of communications endeavor, particularly into the highly regulated, multi-country ones.

Much more has to be done to remove artificial barriers to entry for MSS Systems. This includes addressing licensing barriers, authorization delays, spectrum shortages, and international access in virtually every country around the Globe. The cost of ground equipment and service regulation also continues to be a primary concern for medium and small users and suppliers that prevail in this industry. And, there seems to be a consensus that, in order for the industry to flourish, one must recognize that regulatory parity among competitive services, not simply within the MSS but among all services as well, does not exist and is of paramount importance. This panel "will throw stones!"

Panelists:
F. THOMAS TUTTLE, Former General Counsel, Iridium Satellite Corporation.

PATRICIA MAHONEY, Vice President, Regulatory Policy, Final Analysis Satellite

A. ADIWOSO, Aces Satellite

D. D'AMBROSIO, Vice President, Stratos Mobile

A. AUCKENTHALER, General Counsel, Inmarsat

S. SCHNEIDER, Former General Counsel, BT Mobility

J. ROSE, Satellite Consultant

W. COULTER, Former General Counsel, COMSAT

Industry Experts Analyze Mobile Satellite Industry

Press Release - 2-1-2001

The more than 2,000 telecommunications executives and managers attending the annual Pacific Telecommunications Council ("PTC") 2001 Conference in Honolulu, Hawaii earlier this month got a unique and rare look at the state of the global mobile satellite industry thanks to a diverse panel of experts put together by the PTC in cooperation with Coudert Brothers, a global law firm and the Legal Counsel to PTC.

Bill Coulter, a Partner in Coudert Brothers' Global Telecommunications & Technology Practice, chaired the panel. He is also the General Counsel of the International Mobile Satellite Users Association (MSUA) and the former Vice President and General Counsel of COMSAT International (COMSAT).

The panel, which drew a large following at the Conference – likely due to the major changes re-structurings in the industry last year and expected again in 2001- included:

Adi Adiwoso, President & CEO of the Pacific region company Asia Cellular Satellite Ltd (AceS); **'D. D' Ambrosio**, Executive Vice President of the Canadian company Stratos Mobile Communications, Inc., one of the largest suppliers of GlobalStar and Inmarsat mobile satellite services; **F. Thomas Tuttle**, Vice President and General Counsel of the restructuring Iridium satellite system; **Cheryl Schneider**, former Vice President and Chief Regulatory Counsel for BT, currently AT&T; and **Jeremy Rose**, President of Rose and Associates, an internationally recognized mobile services consultancy with offices in London, Washington and Tokyo.

The panel, entitled "Mobile Satellites – Lessons to be Learned, a Users Perspective" focused on identifying issues and solutions for the challenges facing satellite industry, including: how to avoid and work within country barriers to market entry; how to speed up global non-wireline licensing; how to address spectrum shortages and reallocations; how to seize on opportunities presented by non-governmental entity ("NGO") privatizations and on new land line competitive forces; how to counter solutions to construction and regulatory "lead time" problems; and how to address the impact of the "major three industry concerns" - cost/size/coverage.

Tom Tuttle of Iridium led off the dialog by recognizing with details "the difficulty of achieving prompt and inexpensive market access on a large scale, " indicating that this will need to be addressed by countries and companies that wish to have the benefits of newer systems. Tuttle also indicated his belief that the "new" restructured Iridium will be a "major player", and that "those who can learn from us will shorten their agony."

'D. D' Ambrosio of Stratos noted that users recognize that "each mobile and fixed system has a strength and a weakness. The ability of systems to flourish is directly impacted by the ability of distributors like Stratos to explain the differences to users, and to get providers to adapt to user's changing requirements." He also noted the particular unknown strengths of several systems to his customers.

Adi Adiwosa of ACeS said that "Cost and Service are the keys to regional mobile voice services, ACeS' target user group. If systems give users a service they want, then Government regulators will have no option but to allow them full country access. This may be slow, but it will come." Adiwoso also described unique pricing and access plans that have found new markets for him.

Cheryl Schneider of BT found that "A new system, mobile or fixed, in the future may need to have a foundation customer; Inmarsat, for example, had a governmental "exclusive", now Iridium has a "key Government user" for at least 5 years." GlobalStar has no cohesive user base. "Users, not just systems, must make a commitment to a system for it to grow, suppliers' commitments are not enough anymore." Schneider also noted her in her experience, systems must start earlier on market access", particularly several methods to offset a country's lost of any traditional revenue streams.

Jeremy Rose had a 'fresh look'. He said that "cost is important but service is more important!" Most users don't know that one pays more for roaming cellular in Moscow than it does for Globalstar or Iridium service. So here, service is more important than cost. Also, "frequency is going to be 'key' – broadband access is a must."

In summarizing the panel's thoughts, Bill Coulter noted that "market protection is a major problem, it must end. It will fall as countries realize that there are attractive alternatives to protectionism that doesn't hurt consumers. The USA will have to allow Inmarsat access to the USA market – this exclusionist policy is sending the absolute wrong message to other countries. Frequency access is too expensive and too fragmented. Customs and taxes are too restrictive. These are changing but it is too slow for those not focused. The focus for the next few years is going to have to be size/cost/access/true joint ventures."

$ **Economics & Financing**

Wednesday, 17 January 2001
0830–1000

W.1.6 Fear and Loathing in the Peering Process

Location: South Pacific III

Chair: DAVID ALLEN, Co-Principal, World Collaboration for Communications Policy Research, USA

This session will examine the terms and conditions under which Internet Service Providers interconnect their networks. As the Internet matures into a commercial medium, its structure has become more hierarchical with the largest so-called Tier-1 ISPs able to charge smaller ISPs for network access and transit services. This system of payments contrasts with a previous "sender keeps all" arrangement as well as the traditional settlement arrangement among telecommunication correspondents. This new system imposes comparative higher financial burdens on smaller ISPs, including the ones physically distant from desirable content hosted by North American Tier-1 ISPs. The session will examine both the equity and business factors supporting and opposing the new payment system.

Presenters:

Fear and Loathing in the Peering Process

ERIC LEE, VP, Commercial Internet Exchange, *USA*

Fear and Loathing in the Peering Process (ABSTRACT)

TIM DENTON, Principal, T.M. Denton Consultants, *Canada*

BERNADETTE JEW, Partner, Gilbert & Tobin, *Australia*

PUBLIC POLICY PERSPECTIVE

Click here to start

Table of Contents

PPT Slide

PUBLIC POLICY PERSPECTIVE

GOALS SOUGHT BY SOME STATES AND PTOs

PPT Slide

CRITICISMS OF SPA MODEL BY NON-US PROVIDERS

HISTORICAL FACTORS

PPT Slide

ITU CONFERENCE

CONCLUSIONS

Author: Eric Lee

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FEAR AND LOATHING IN THE PEERING PROCESS

PTC 2001
Hilton Hawaiian Village
Honolulu, Hawaii
January 17, 2001

Eric Lee
Public Policy Director
Commercial Internet eXchange Association

PUBLIC POLICY PERSPECTIVE

- CONTINUATION OF ISSUE OF SHARED TRANSPORT COSTS
- ISSUE RAISED IN GLOBAL FORUM
- NEW AND POSSIBLY UNSETTLING POLITICAL UNCERTAINTIES INTRODUCED

GOALS SOUGHT BY SOME STATES AND PTOs

These are some of the goals articulated by various governments and PTOs in support of an international Internet cost-sharing arrangement. Some have been sought since the beginning of the debate over cost-sharing.

- Develop domestic infrastructure
- Develop regional hubs
- Develop domestic national and local hubs and richer interconnection
- Develop local content
- Develop “digital opportunities”
- Promote consumer and commercial Internet access

Issue began as an international public policy controversy with European providers/carriers in mid-1990s

Traditionally US providers, carriers, and USG have opposed Internet cost-sharing

Most recent incarnation was in APEC with ICAIS

Cost sharing has become global issue as a result of ITU's intervention

CRITICISMS OF SPA MODEL BY NON-US PROVIDERS

- Unfair and economically burdensome (very high Telstra figures)
- Internet “backbone” not competitive
- Concern of other countries that Internet will remain “US-centric” (or English centric)

Some local US ISPs and regional providers also concerned about peering but not as much

HISTORICAL FACTORS

- Internet started in US
- Others connected first to the US backbone (USG network)
- Much of desired content and desired sites in US and Canada (NA)
- Dominance of users in US and Canada though there has been rapid A/P and European gain
- US still “regional” hub as result of low rates and competition but Europe also becoming attractive

SIGNIFICANT DEVELOPMENTS IN 2000

Markets

- Surge in non-US users, especially in Asia/Pacific and Latin America
- Changes in access technologies, especially wireless, where Japan and Europe lead
- Growing non-US, non-English content
- Announcements of non-US regional hubs, competitive pressures
- Voluntary release of peering policies by some US backbones

Technology

- Distribution technologies (caching) improve, become attractive
- CDNs and storage hardware and networks

Globalization of Cost-sharing Issue

- ITU involvement
- Montreal Conference - October 2000

ITU CONFERENCE

Breakdown into roughly three voting blocs

- **US, Canada, Italy, UK, Netherlands, Sweden, Germany**
- **Most of Europe**
- **Asia/Pacific, Latin America, Africa, and Middle East**

Outcome: SG3 policy recommendation changed and returned to SG3 for review by time certain

CONCLUSIONS

- US and most of other cost-sharing opponents will be adamant in their position
  - Impact of Bush Administration political direction
  - US private sector organizing to oppose creeping regulation, internationalization, and centralization
- Will market, network, and technological changes defuse issue?
- ITU's dilemma - institutional interest in asserting authority over Internet issues without enforcement tools and potential political repercussions

Fear and Loathing in the Peering Process

Click here to start

Table of Contents

Author: Tim Denton

Fear and Loathing in the Peering Process

The Internet is a fundamental redesign of communications

The rate of change is driven by software

Proportion of voice traffic sinks

The Internet has been kept free of price regulation

Connecting networks is a matter of negotiation

Financial Arrangements for Interconnection

Accounting for Packets is Difficult or Impossible

Consequences

Peering and Transit Defined

The Transit Model

The Peer Model

Further Effects of Peering

Payment Arrangements

How connection deals are made

Who are the peers? Tier 1 ISPs

Political Issues

Intervention by the ITU?

Alternative Business Models

The Internet Interconnection Model

Prospects

Fear and Loathing in the Peering Process

A presentation to the Pacific
Telecommunications Council
January 2001

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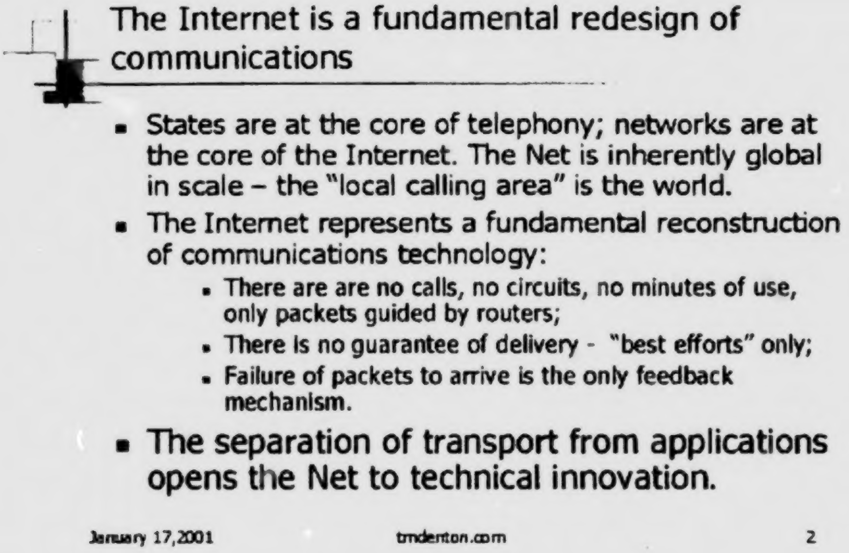
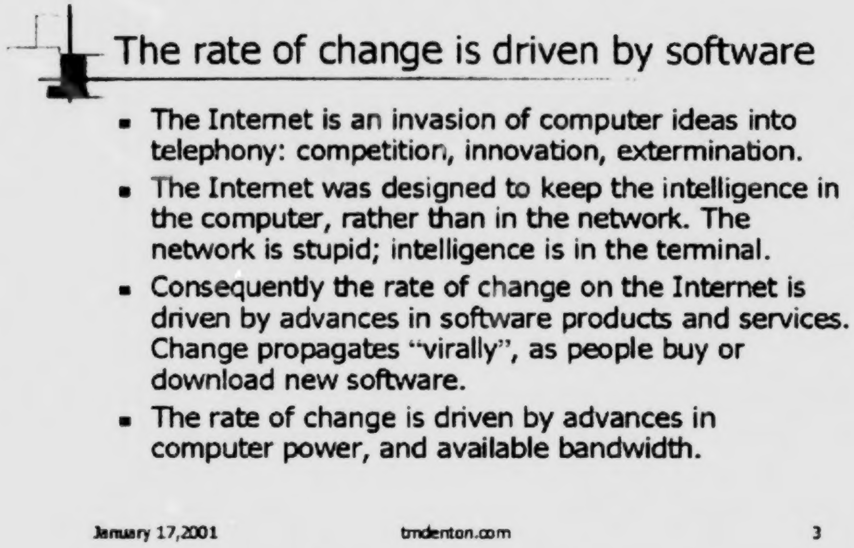
Slide 1 of 21



The Internet is a fundamental redesign of communications

- States are at the core of telephony; networks are at the core of the Internet. The Net is inherently global in scale – the "local calling area" is the world.
- The Internet represents a fundamental reconstruction of communications technology:
  - There are are no calls, no circuits, no minutes of use, only packets guided by routers;
  - There is no guarantee of delivery - "best efforts" only;
  - Failure of packets to arrive is the only feedback mechanism.
- The separation of transport from applications opens the Net to technical innovation.

Slide 2 of 21

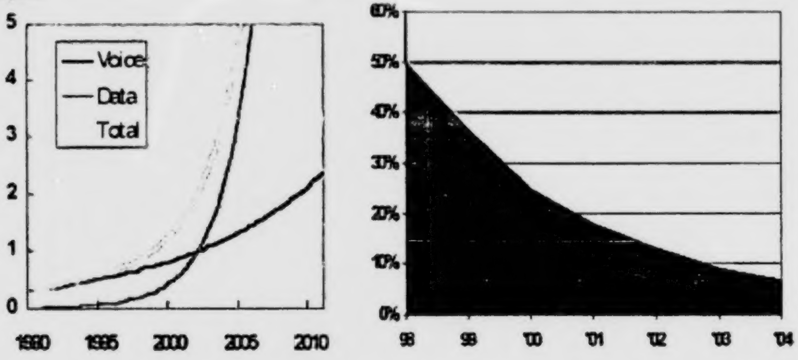


The rate of change is driven by software

- The Internet is an invasion of computer ideas into telephony: competition, innovation, extermination.
- The Internet was designed to keep the intelligence in the computer, rather than in the network. The network is stupid; intelligence is in the terminal.
- Consequently the rate of change on the Internet is driven by advances in software products and services. Change propagates "virally", as people buy or download new software.
- The rate of change is driven by advances in computer power, and available bandwidth.

Slide 3 of 21

Proportion of voice traffic sinks



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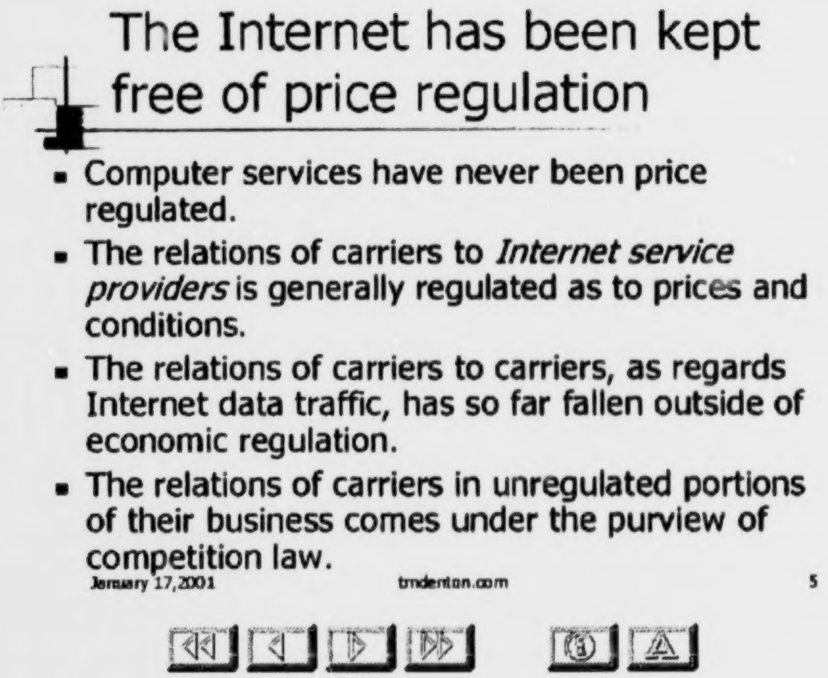
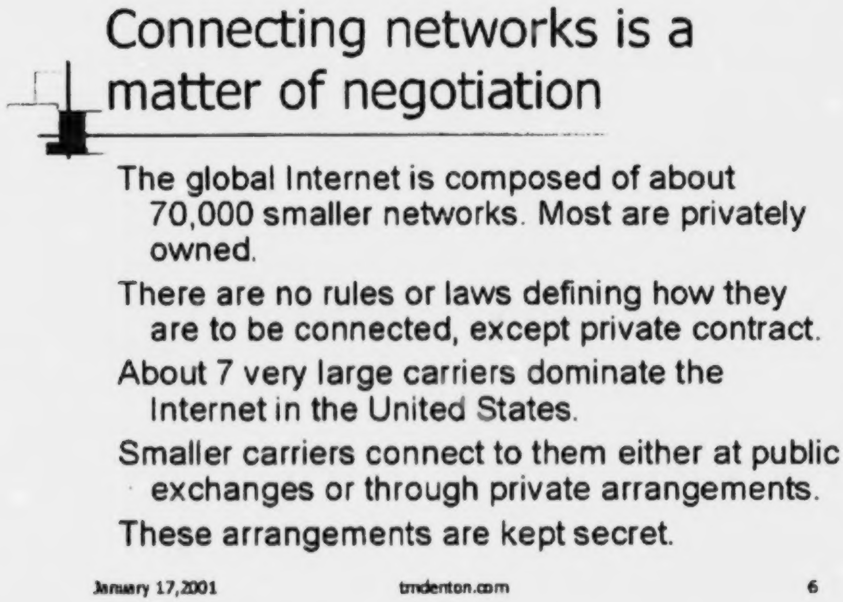


The Internet has been kept free of price regulation

- Computer services have never been price regulated.
- The relations of carriers to *Internet service providers* is generally regulated as to prices and conditions.
- The relations of carriers to carriers, as regards Internet data traffic, has so far fallen outside of economic regulation.
- The relations of carriers in unregulated portions of their business comes under the purview of competition law.

January 17,2001 tmdenton.com 5

Slide 5 of 21



Connecting networks is a matter of negotiation

The global Internet is composed of about 70,000 smaller networks. Most are privately owned.

There are no rules or laws defining how they are to be connected, except private contract.

About 7 very large carriers dominate the Internet in the United States.

Smaller carriers connect to them either at public exchanges or through private arrangements.

These arrangements are kept secret.

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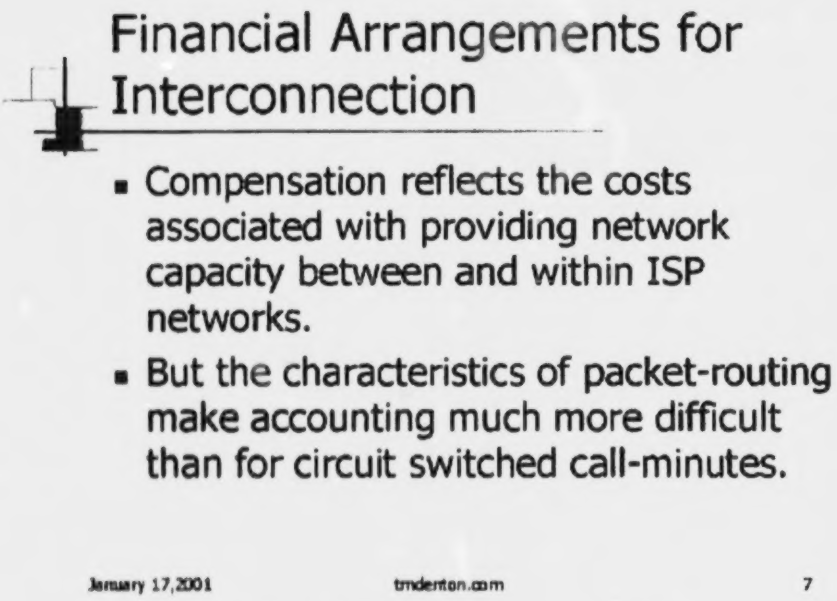
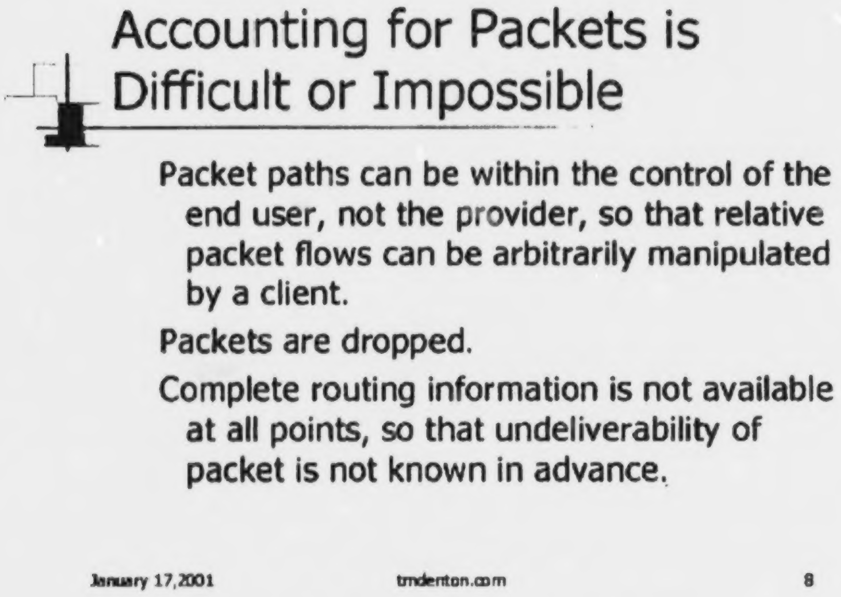


Financial Arrangements for Interconnection

- Compensation reflects the costs associated with providing network capacity between and within ISP networks.
- But the characteristics of packet-routing make accounting much more difficult than for circuit switched call-minutes.

Slide 7 of 21



Accounting for Packets is Difficult or Impossible

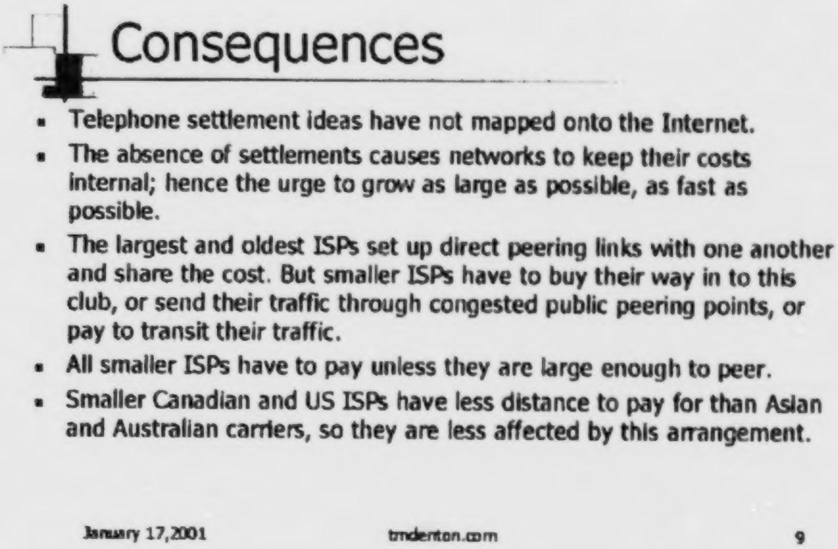
Packet paths can be within the control of the end user, not the provider, so that relative packet flows can be arbitrarily manipulated by a client.

Packets are dropped.

Complete routing information is not available at all points, so that undeliverability of packet is not known in advance.

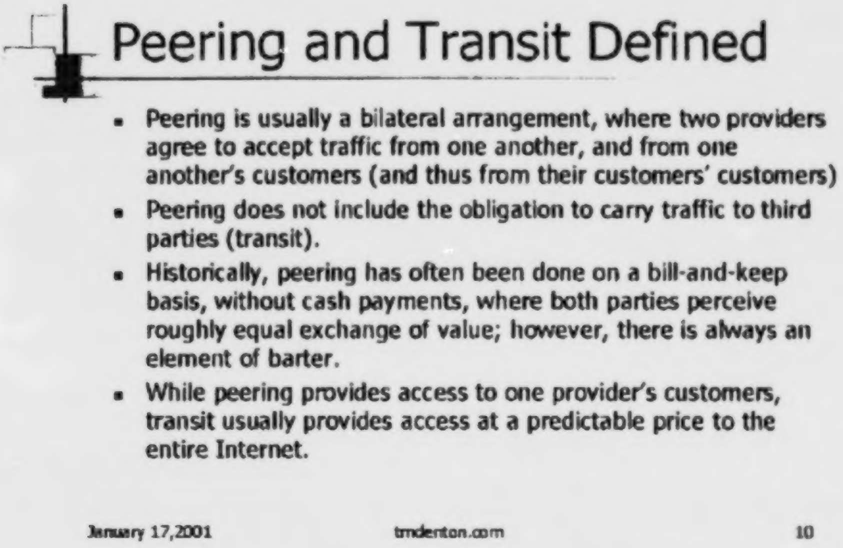
January 17,2001 tmdenton.com 8

Slide 8 of 21



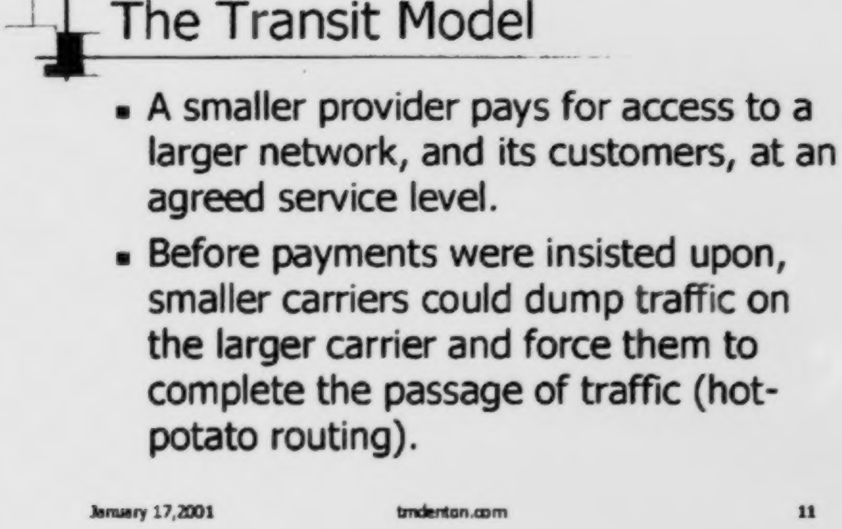
Consequences

- Telephone settlement ideas have not mapped onto the Internet.
- The absence of settlements causes networks to keep their costs internal; hence the urge to grow as large as possible, as fast as possible.
- The largest and oldest ISPs set up direct peering links with one another and share the cost. But smaller ISPs have to buy their way in to this club, or send their traffic through congested public peering points, or pay to transit their traffic.
- All smaller ISPs have to pay unless they are large enough to peer.
- Smaller Canadian and US ISPs have less distance to pay for than Asian and Australian carriers, so they are less affected by this arrangement.



Peering and Transit Defined

- Peering is usually a bilateral arrangement, where two providers agree to accept traffic from one another, and from one another's customers (and thus from their customers' customers)
- Peering does not include the obligation to carry traffic to third parties (transit).
- Historically, peering has often been done on a bill-and-keep basis, without cash payments, where both parties perceive roughly equal exchange of value; however, there is always an element of barter.
- While peering provides access to one provider's customers, transit usually provides access at a predictable price to the entire Internet.



The Transit Model

- A smaller provider pays for access to a larger network, and its customers, at an agreed service level.
- Before payments were insisted upon, smaller carriers could dump traffic on the larger carrier and force them to complete the passage of traffic (hot-potato routing).

January 17,2001 tmdenton.com 11

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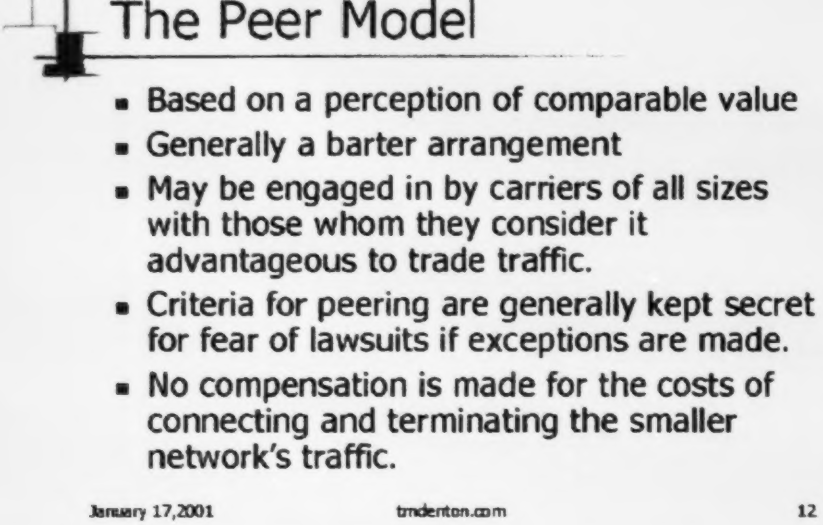
Slide 11 of 21

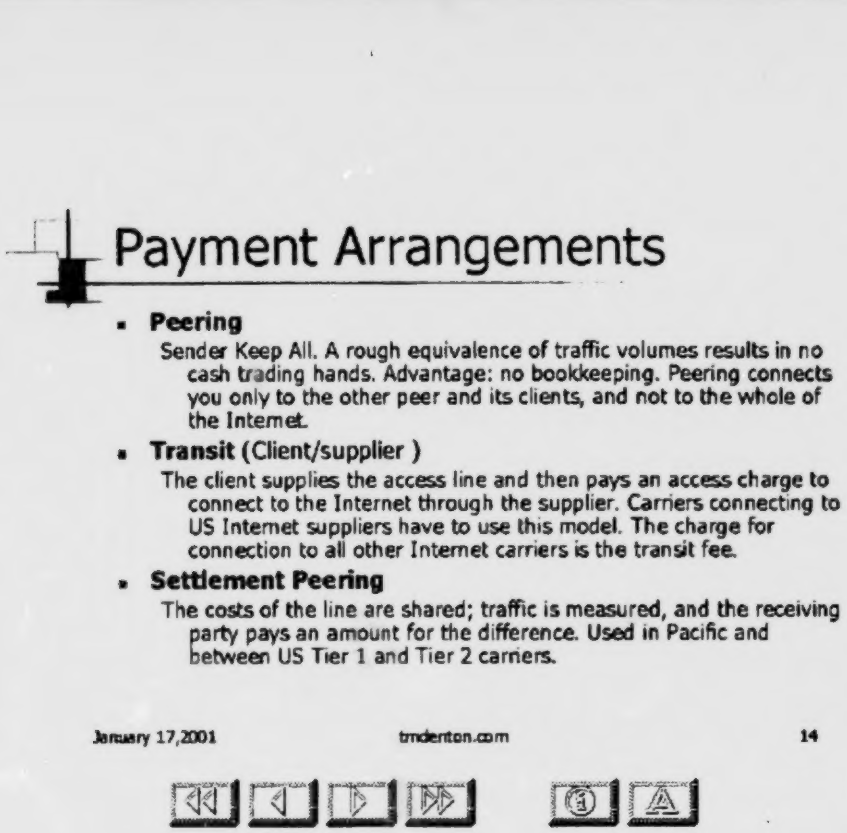


The Peer Model

- Based on a perception of comparable value
- Generally a barter arrangement
- May be engaged in by carriers of all sizes with those whom they consider it advantageous to trade traffic.
- Criteria for peering are generally kept secret for fear of lawsuits if exceptions are made.
- No compensation is made for the costs of connecting and terminating the smaller network's traffic.

Further Effects of Peering

- Peer status is useful because there are no agreed metrics for evaluating the quality of internet connections.
- Most existing Tier 1 providers prevent existing customers from becoming peers.
- The dilemma of the smaller ISP is acute: offer cheaper rates, buy an existing ISP, or pay for high-quality interconnections to an existing larger ISP.



Payment Arrangements

- **Peering**

  Sender Keep All. A rough equivalence of traffic volumes results in no cash trading hands. Advantage: no bookkeeping. Peering connects you only to the other peer and its clients, and not to the whole of the Internet.

- **Transit** (Client/supplier)

  The client supplies the access line and then pays an access charge to connect to the Internet through the supplier. Carriers connecting to US Internet suppliers have to use this model. The charge for connection to all other Internet carriers is the transit fee.

- **Settlement Peering**

  The costs of the line are shared; traffic is measured, and the receiving party pays an amount for the difference. Used in Pacific and between US Tier 1 and Tier 2 carriers.

January 17,2001 tmdenton.com 14

Slide 14 of 21

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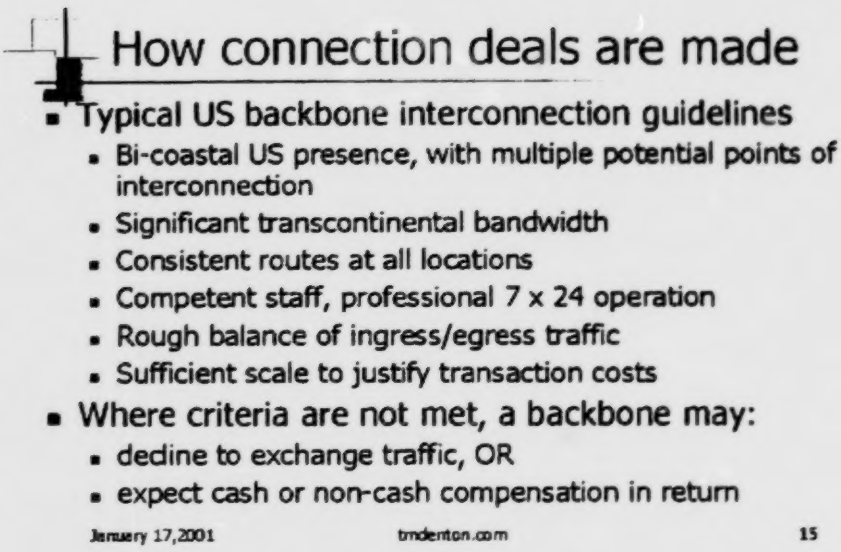

How connection deals are made

- Typical US backbone interconnection guidelines
  - Bi-coastal US presence, with multiple potential points of interconnection
  - Significant transcontinental bandwidth
  - Consistent routes at all locations
  - Competent staff, professional 7 x 24 operation
  - Rough balance of ingress/egress traffic
  - Sufficient scale to justify transaction costs
- Where criteria are not met, a backbone may:
  - decline to exchange traffic, OR
  - expect cash or non-cash compensation in return

Slide 15 of 21

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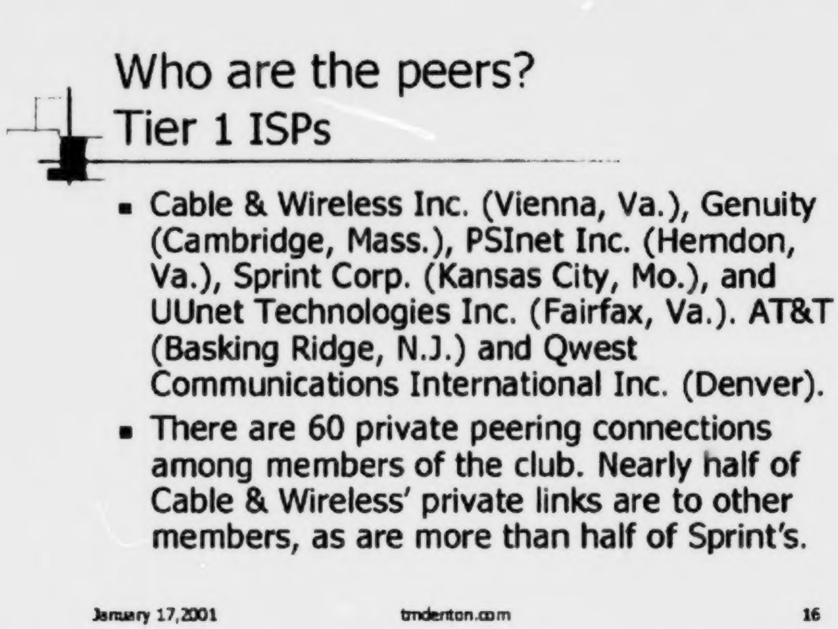
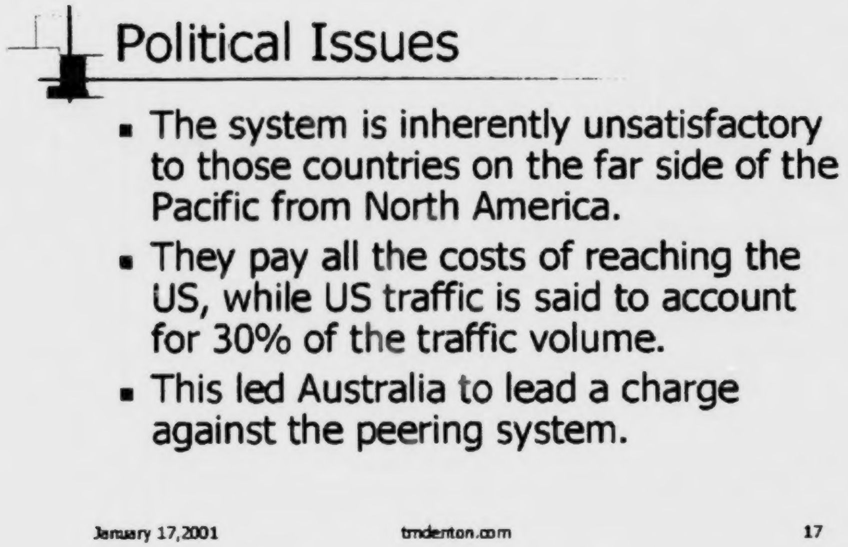


Who are the peers? Tier 1 ISPs

- Cable & Wireless Inc. (Vienna, Va.), Genuity (Cambridge, Mass.), PSInet Inc. (Herndon, Va.), Sprint Corp. (Kansas City, Mo.), and UUnet Technologies Inc. (Fairfax, Va.). AT&T (Basking Ridge, N.J.) and Qwest Communications International Inc. (Denver).
- There are 60 private peering connections among members of the club. Nearly half of Cable & Wireless' private links are to other members, as are more than half of Sprint's.

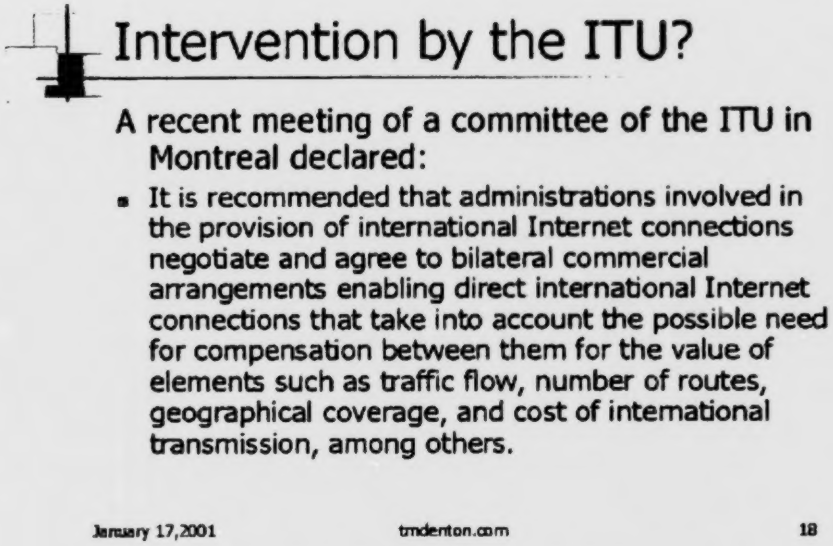


Political Issues

- The system is inherently unsatisfactory to those countries on the far side of the Pacific from North America.
- They pay all the costs of reaching the US, while US traffic is said to account for 30% of the traffic volume.
- This led Australia to lead a charge against the peering system.

January 17,2001 tmdenton.com 17

Slide 17 of 21



Intervention by the ITU?

A recent meeting of a committee of the ITU in Montreal declared:

- It is recommended that administrations involved in the provision of international Internet connections negotiate and agree to bilateral commercial arrangements enabling direct international Internet connections that take into account the possible need for compensation between them for the value of elements such as traffic flow, number of routes, geographical coverage, and cost of international transmission, among others.

January 17,2001 tmdenton.com 18

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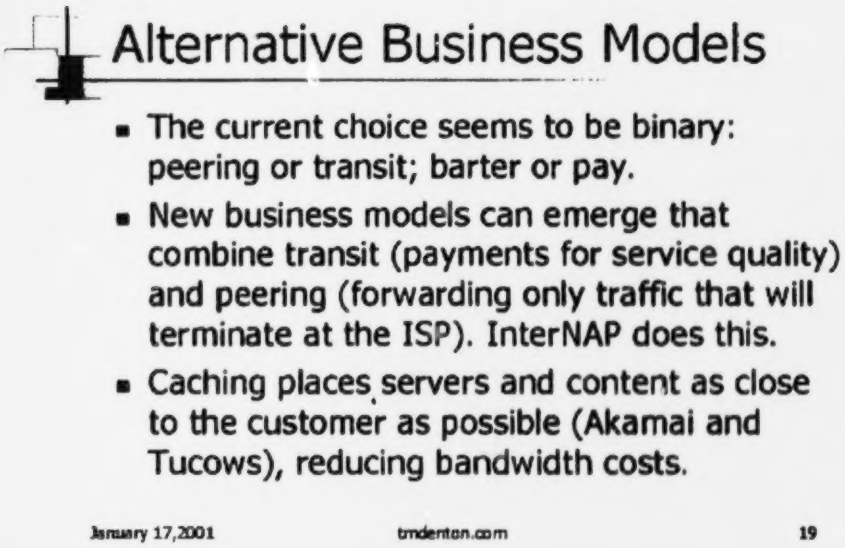
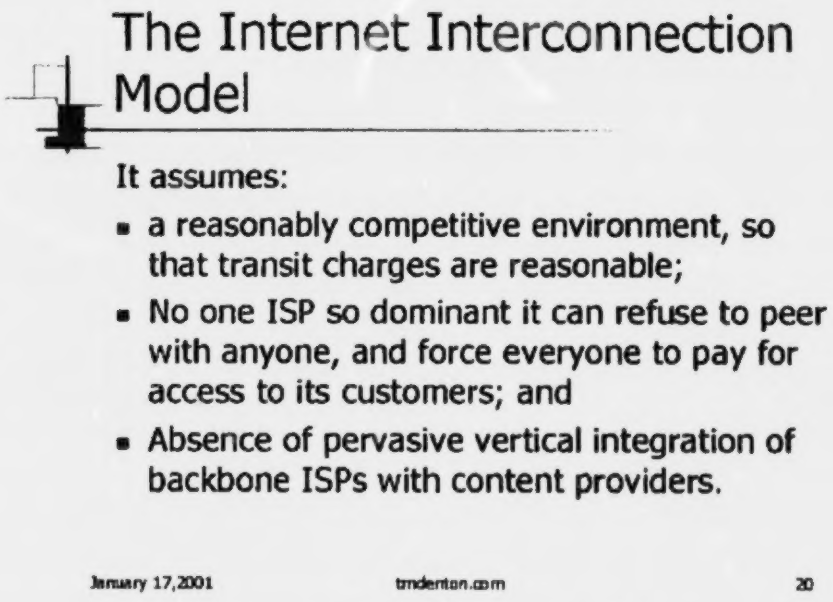


Alternative Business Models

- The current choice seems to be binary: peering or transit; barter or pay.
- New business models can emerge that combine transit (payments for service quality) and peering (forwarding only traffic that will terminate at the ISP). InterNAP does this.
- Caching places servers and content as close to the customer as possible (Akamai and Tucows), reducing bandwidth costs.



The Internet Interconnection Model

It assumes:

- a reasonably competitive environment, so that transit charges are reasonable;
- No one ISP so dominant it can refuse to peer with anyone, and force everyone to pay for access to its customers; and
- Absence of pervasive vertical integration of backbone ISPs with content providers.

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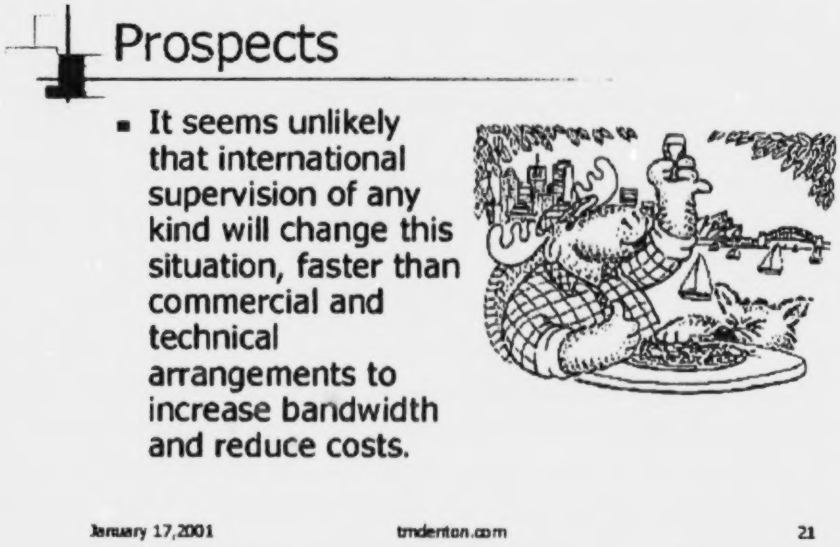

Prospects

- It seems unlikely that international supervision of any kind will change this situation, faster than commercial and technical arrangements to increase bandwidth and reduce costs.

Slide 21 of 21

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Timothy Denton practices in Internet regulatory and policy issues in Ottawa, Canada.

He acts for domain name suppliers, Internet service providers and also consults to international organizations and the federal government in Internet policy issues.

Currently he is working on the expansion of domain names in the ICANN forum. He recently completed a study of international charging arrangements for Internet services for the APEC Telecommunications Committee.He is the author of "Bellheads versus Netheads", and "The Internet Illustrated", found at his website.He recently attended the invitation-only "Big Hook" conference on the network of the future at Wood's Hole, Massachussetts, hosted by David Isenberg. He holds a Bachelor of Civil Law (BCL) from McGill University. His undergraduate degree from the same university was in political science and philosophy. His speeches, writings, and regulatory submissions are found, together, with a profile of his firm, at the website www.tmdenton.com.

Mr. Denton has been a consultant since 1980 and in private practice since 1988. He has worked at: the Privy Council Office (the cabinet office of the federal government), the Canadian Radio-television and Telecommunications Commission in the 1970's, and the Office of the Minister of Communications in the latter part of the 1980's. In his time at the Minister's office, he was instrumental in allowing long-distance resale, which led directly to hearings that allowed long distance facilities-based competition.

Back to preceeding page | Back to sessions page

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Social / Cultural

Wednesday, 17 January 2001
1030–1200

W.2.1 Overcoming Digital Divide

Location: South Pacific I

Chair: TERRY CHARMAN, Managing Director, TCI & Associates, *Australia*

W.2.1.1 Information Technology For Education, Governance and E-Commerce (ABSTRACT)

T.H. CHOWDARY, Information Technology Advisor, Government of Andhra Pradesh & Director, Center for Telecommunications Management and Studies, Hyderabad, *India*

W.2.1.2 Sign Language Users and Visual Communications: The Deaf Australia Online Projects (ABSTRACT)

CLAUDIA SLEGERS, Associate Research Fellow, Center for International Research on Communication and Information Technologies, CIRCIT, RMIT and JANICE KNUCKEY, Coordinator, Center for Excellence for Students Who are Deaf and Hard of Hearing, Access Department, Preston Campus, Northern Metropolitan Institute of TAFE, *Australia*

W.2.1.3 The Dilemma of Digital Delivery: Assuring Access to Digital Resources as Technologies Change (ABSTRACT)

CAROLE ANNE ALCOCK, Lecturer, School of IT & Computer Science, University of Wollongong, *Australia*

W.2.1.4 Sustainability and Training in the Community Telecenter Movement (ABSTRACT)

ROYAL D. COLLE, Professor, Department of Communication, RAUL ROMAN and ABIGAIL PFIESTER, Cornell University, *USA*

Information Technology for Education, Governance and E-Commerce

T.H.Chowdary

Abstract

1. IT FOR CLASSES AND MASSES:

Computers, Software, Information Technology, Internet are thrilling words in India. Stories of a number of Indians in the US and in India becoming millionaires and billionaires in a short period; information technology stocks rising to dizzy heights on the stock exchanges; Chief Minister Mr.N.Chandra Babu Naidu of the state of Andhra Pradesh talking about these to electors in the villages and winning the elections have made students and parents alike to go to training classes for use of computers. There are more than 2000 training institutes in the country. This is a business netting in over US $ 500 million per year for these training institutes. Upper primary school kids in the rural, remote areas even aspire to become Bill Gates. Ask why? They say that computers will make them millionaires. Almost all daily newspapers have at least one page every week writing about Internet, computers, software, e-commerce, telemedicine and electronic governance. Hundreds of Dot Com companies are being registered week after week in the country. In some of the cities hundreds of small (2 to 5 persons) teams develop some application or the other or create web sites and ask to be put on portals. Growth of the exports of Indian software and other IT products in India had been phenomenal. In the year 1999-2000 it was nearly US $ 4 billion. The country's target is annual exports of US $ 50 billion by the year 2010 - a figure larger than the current total of India's exports. Private companies and governments are competing with one another to go electronic for all their operations. Information Technology is sought to be utilised for education, health, commerce, and governance, besides entertainment, communications and such traditional activities. Government policies are to convert nearly a million public telephone booths into Internet kiosks, so that, even if most of the houses and offices do not have a telephone or PC, people can still use the telephone as well as the Internet. This is already happening with varying success in different states. For example in the state of Andhra Pradesh, Internet service will be provided in all the eleven hundred and odd lowest level towns which are also the centres of government administration, before the 31st of March 2001. This paper gives an account of use of IT in significant areas such as education, health, governance and e-commerce mainly in the state of Andhra Pradesh (area 310, 000 sq kms: population; 75 million: capital city: Hyderabad [Cyberabad]). Andhra Pradesh is the first state, which has popularised IT for the masses as well as the classes. It is a state whose Chief Minister Mr. N.Chandra Babu Naidu has become the mascot for IT.

2. GOVERNANCE AND E-COMMERCE IN INDIA.

2.1 India aims to export Information Technology products and software services to global markets to earn US $ 50 billion per year by the year 2010 (in the fiscal 2000 it was US $ 4.0 billion). This requires one million world class IT professionals. Besides these, India wants to capture 10% of the world market in IT-enabled services. This would require 70 to 100 million computer skilled English speaking graduates. India has over 800 engineering colleges producing about 200,000 engineering graduates a year. We want to double this number with world-class capabilities. India needs to have all its educated people from the upper primary onwards to be computer -literate. The requirement of teachers and lecturers is immense. All over the country, hundreds of institutions for IT education and operational skills are coming up (over 2000 by March 2000) by private initiative. In the private sector alone, IT education is now US $ 500 million per year business. There is already a shortage of about 1200 lecturers/professors for the IT sector alone. Those who are teaching IT and are engaged in the profession have to continuously upgrade themselves i.e there is need for continuous learning. All these requirements can be largely met if IT itself is used for the solution. The university level engineering and computer application colleges are equipping themselves with electronic classrooms. A network of optical fibre cables in the ground and communication satellites in space are planned to be used to connect up all the engineering and professional colleges. Lectures from the professors from selected sites are delivered over the communication network to all the electronic class-rooms, spread over all the state. These are planned to be interactive, online for audio and video. One Open University (Bheema Rao Ambedkar Open University in Hyderabad) has already prepared a few hundred multimedia lessons on various subjects. These are available on a web site on the Internet. These can be accessed from various cities where there are contact classes, with Internet connecting PCs. Hundreds of IT kiosks are being established on the campuses of universities and colleges for students to avail of the multimedia educational material. Broadband, high speed, digital electronic photonic highways are being established by competing companies. A number of progressive governments in the States are facilitating the quick rollout of these information infrastructures. Where private companies are not coming forward and where the regulatory restrictions preclude them a progressive government like that of Andhra Pradesh has taken two transponders (72 Mhz) in the Ku band from an INSAT satellite apace segment. Beginning on 1st November will be made available to all the educational institutions besides governments own programmes for information, instruction and inspiration. As of 1.11.2000, 54 Schools and colleges have been equipped with Ku band VSATs to receive lessons uplinked from a central place for six hours a day; full audio and video interactivity will be available in the next phase by March 2001. Government of Andhra Pradesh is involving private sector in all levels of education, more so at the University level ---- 150 Engineering, 50 Medical and dental; 116 MCA and 414 BCA colleges, over 80% in private sector. The experience with the first compliment of electronic class rooms (November 2000) will be used to get all the private colleges to install the Ku band VSATs and associated class-room equipments. The shortage of lecturers/professors and competition among colleges to get students is enthusing college managements to go in for e-class rooms. Government of Andhra Pradesh is inducing cable TV operators in over 1200 towns and villages to install Ku band V-SAT receive only terminals offering them tax concession to set off against their capital expense to install VSATs. One channel of the Cable TV will carry educational programmes. Actually, India is one of the earliest countries to realise that information and communication technology could be utilised for public education. We had SITE (Satellite Instructional Television Experiment) programmes in the mid-1970's itself. Hundreds of receive- only earth stations were built in community centres. Government was using the communication satellites for broadcasts on health, education, community development and even governance through the earth stations. Now audio capability is being built into the ground stations so that while listening and viewing, the audience could interrogate the broadcasting speaker. Lessons delivered through the satellite are received enthusiastically in the primary schools, especially those in the rural areas where the quality of teachers is poor and their instruction is uninteresting. Surveys to assess the impact of satellite delivered education are planned.

2.2. The challenge is to produce educational content and also to link up the hundreds of professional colleges that are coming up very rapidly because of the country's hyped attention on IT, computers and software. A number of content creators are coming up. A number of private sector companies, which have been in the IT training business, are setting up virtual universities/learning centers on the Internet. India's top two IT educational companies are offering courses over the net to candidates in the US and Gulf countries.

2.3 In order to promote education among adults, one of India's largest IT company has launched in Andhra Pradesh a computer based instructional programme to make illiterates to acquire proficiency to read. The illiterate adults assemble in a classroom. Multimedia lessons are prepared on the computer for recognition of letters and words following the instructions and visuals on the computer screen, participants pick up the letters of words displayed on the monitor, from among a stack of cards, assemble them to form the word on the monitor. They learn to recognise and read. Participants thus come to read before they learn to write. A village assistant helps them. Within a few days participants are able to read newspapers and other book material supplied to them. It is a great rewarding experience for them and almost every one of them is soon enthused to learn to write letters of the language itself. The adults are educated not through the ability to write but by inculcation of the ability to read first and then going on to writing itself. This public-spirited company has adopted about hundred villages; it donated the computers, the programmes and deployed trained assistants for a few months. The example is being picked up by several other companies, which are conducting such classes at their own expense in the villages from which they draw their labour.

3. IT FOR GOVERNANCE

3.1. The state and union governments are the collectors of the largest amount of money by way of taxes from the people and companies and they are also the most inefficient and unaccountable spenders of the money. Because of the socialistic pattern of society that was until very recently the policy of many of the parties born from Congress, the governments have been the providers of many services but (passenger bus transport, hotels, bread-making, marriage halls, fish and meat supplies etc), all of them inefficient. I.T.based E-governance is realised to be the least expensive, most efficient and greatly transparent system both for the government to be effective and to deliver services to citizens with the least complexity and corruption. The government of Andhra Pradesh (a south central state) is the pioneer for e-governance in India. Under a visionary programme, it has been computerising many of its activities, especially those which concern the citizen for, they have the largest visibility to inspire confidence in electronic governance CARD (Computer-aided Administration of Registration Department) and TWINS (Twin Cities i.e., Hyderabad and Secunderabad Network Services) are two of the completed projects, which are most people-oriented.

3.2. There are 214 offices of the state government where every sale of property like land and buildings is registered. The purchaser wants to know whether the property he intends to buy is encumbered and so he would like to know all the mutations in the last 50-100 years. He wants to know what is the stamp duty payable on the sale/purchase of a particular property, which means that its value as determined by the government should be available. All these transactions used to be very vexatious and long-drawn and delay was leading to corruption. Now, all the old registration deeds have been computerised and all properties have been valued and these are in computers. The registration deed is also standardised. A person can go to the registration office give the address of the properties he wants to buy and ask for an encumbrance certificate. He gets it within 3 minutes. He wants to know what is the value for registration purpose; he gets in another 2-3 minutes. The stamp duty he has to pay is also given as a print-out. If he wants to register the deed he pays the amount and speaks out the details of who is selling, who is buying and for what consideration and the Assistant at the counter enters them into the computer. The whole business is over in a few minutes. ***The time for registration of land transfers had been reduced from 10 days to less than one hour. In the last 18 months (ending September, 2000) 1.0 million documents were registered.*** The farmers and other citizens are stunned by the ease and quickness with which they are able to register their documents. Earlier, they would make at least half a dozen visits to the office, all of them involving considerable expense and travel and stay in the town as well as graft money. These are declining. Now all the registration offices in the entire state are being networked. When this is completed, one need not go to the registration office which is situated in the area where the property is sold or purchased or transferred; it could done from any one of the registration offices because of networking.

Great effort was put in by senior officers of the government, including the Chief Minister himself to enthuse the Government officials to take to computerised operations in the registration offices. ***Their mind-set was changed from one of condescension to service; from one of getting gratified to one of being blessed. Government first thought of entrusting the computerised registration (and other) work to private companies. Officials resisted; they said that it is their privilege and duty to render public service; they won't abdicate it in favour of private agencies. They agreed to be computer-trained and truly service-rendering. This dialogue helped to change the mind-set.*** This CARD service is one of the demonstrable triumphs of computerised services by Government to citizens.

3.3 Network Services to Citizens

3.3.1 TWINS is a project to deliver different government services to citizens at one single point. In Hyderabad city currently, 19 services like payment for issues and renewal of driving licence, issuance of birth certificate; payment of property tax, electricity, telephone, and water bills and so on are all transacted at one of the several counters, a number of which are opened in different parts of the city. A citizen going to different places at great expense is avoided to his great relief.

The service is so much appreciated by citizens that it is extended to more localities in the city so that people have to travel less. ***As Government does not want to invest the considerable capital required, the initial scheme is modified to require a private company to put in the capital and earn the revenues required through transaction charges; i.e., pricing every service rendered. The prices charged are to be approved by Government.***

3.3.2 The capital city Hyderabad of the state of Andhra Pradesh is connected to all the districts and a few important towns (25 in all) on a 2 Mbps optical fibre based State Wide Area Network (SWAN). Various offices of the state government's headquarters in Hyderabad are connected on a metropolitan area net (MAN) work. Each office has a LAN. This network, of SWAN is used for exchange of all information (voice, text, and video besides data) amongst all the government offices. The greatest use that it is being put to is the video conferencing amongst all the government offices in the State (280,000 sq kms, 23 administrative districts and 1140 sub-districts to serve 29000 villages and a population of 75 millions). All government departments are putting the information that should be given to the public on their respective web sites. These could be accessed from TWINS sites. In the next phase, (April, 2001) there will be a number of kiosks in different places connected to this network so that a citizen can go into any of them and get the information he wants. Many citizens may not have a PC; more may not be able to work on the PCS; so we have attendants who would assist the citizen for his work. The citizen may pay a charge per transaction for every service he gets.

3.3.3 To provide universal access to this government network services, the example of the public telephones is there. The teledensity in India is under 3% but a public telephone (PT) is accessible within 500 meters of everybody's residence or office in all the 4000 urban areas of the country. A PT is also available in 2/3rds of the 600,000 villages in the country. The country is now implementing the programme of transforming these public telephones into public tele-information centres (PTICs) by fitting them with a PC and an Internet connection. From these booths citizens will be able to get the services he needs from government.

3.4 Programs of electronic governance G2B; G2G; G2C (government to citizen) (B2B and B2C are for electronic commerce) are being implemented vigorously. In AP, the network is specified by government and implemented on a ***build-own-operate (BOO) basis to derive several advantages like no investment from a resource strapped government, no need to replace obsolete/inadequate capacity systems for growing need, frequently; better maintenance, among others.*** The pioneering programs of the government of Andhra Pradesh are adopted and improved by other State governments in a friendly emulative and even competitive spirit. Almost all governments are computerising their work and the Union Ministry of Information Technology (MTI) is stimulating departments and Ministries to migrate to e-governance rapidly. Hundreds of small entrepreneurs are coming forward to develop applications for e-government, education and for interaction between governments and citizens.

3.5 Here are a few instances of the use of IT for efficient governance and for direct involvement of the people

- A computerised management information is put in place for use by the Chief Minister's and ministers and senior Government officers in the State of Andhra Pradesh. Public distribution (Kerosene, sugar and food grains at subsidised rates for poorer sections) of the System is the most people-sensitive responsibility of the Government. Supplies and shortages are closely monitored almost on a daily basis.

- All the treasuries are computerised. Money coming into the coffers of the Government and out payments are known by the close of the day. The financial position is thus closely monitored. It was perilous a few years ago when Government had even to borrow money to pay the salaries but the computer-assisted management has avoided such borrowings.

- The generation and distribution of electricity, which is the state's function, has always been a matter of worry because of power shortages. The computerised monitoring has helped to push up the plant load factor from 65% in 1995 to 92% by 1998. ***This meant the avoidance of an investment of US $ 1.5 Billion in generating capacity.***

- Gastro enteritis used to be a killer. Computerised information management from the village level upwards, has drastically reduced the incidence of the disease from 35,000 in 1998 to 12,500 in 1999 and deaths from 886 in 1998 to 72 in 1999. This involved the integrated management of the Department of Health, Panchayati Raj, Municipal Administration, Public Information and Revenue.

- Digitisation of 48,000 Kilometres of roads in the State has helped to improve the quality of road construction and maintenance and therefore the reduction expenditure on the roads. Which contractor was involved, in what stretch of the roads, in which year and for what amount is known. Any stretches that came up for repair or redoing could be related to the contractor who did the work and therefore the assessment of the contractor could be made. Bad ones could be punished and blacklisted for further works.

- The State now has a citizen database for all the households (about 16 million) giving the profiles, villagewise of every family, the land holding, the income, occupation, education, health, electricity, drinking water and sanitation. **Government efforts say**, for family planning (to have no more than two children) ***are now targeted towards those sections/communities which are having large families. So are the efforts for promoting literacy and alleviating the chronic poverty.***

  In this program every Monday evening for one hour the Chief Minister is engaged in a radio and TV interactive program over phone-in telephone lines with citizens. The subject to be discuss and debated is publicised in the newspapers one or two days in advance. Citizens are invited to question and debate with the Chief Minister. Such programs are now extended to involve district magistrates municipal commissioners the chairman of district administrative councils, the superintendents of police, chiefs of public health and irrigation etc., in all the 25 administrative towns over the local cable TV network. These are acting as electronic town halls.

4. ELECTRONIC COMMERCE:

4.1 As elsewhere in the world, this is going to be the greatest transformational activity and enterprise in India. Internet services came to be introduced in India on a monopoly basis in the middle of 1995. In 1998 the monopoly was abolished and the Union government promulgated one of the most liberal policies anywhere in the world. There is no limit on the number of companies; there is no entrance fee, no revenue share, no licence fees. The Internet Service Provider's (ISP) can build and operate their own international gateways and they can pick up customers themselves by deploying wireless access equipments. They can also interconnect their server sites in different cities by building their own telecommunication transmission infrastructure to link up the cities. This is in effect a total bypass of the existing public switched telephone networks. The only condition that government imposed is that the ISPs should not allow voice on the internet, a ban which is difficult to enforce and is also unreasonable.

4.2 It is because of this extremely liberal policy that the Internet service is exploding. Within 18 months (since November, 1998), the number of users increased by five times and the prices fell in to 1/5th. In the meanwhile, government has enacted an IT law which among others, recognises digital signatures and electronic documents and electronic funds transfers. These have formed the basis for the emergence of e-commerce. In anticipation of this policy, a few private companies have built up a 30 city, 2 MBPS information infrastructure by leasing bandwidth from the incumbent telecom enterprise, the Department of Telecom Operations (DTO). It has acquired or concluded alliances with a number of DOT. COM companies. It is building up portals for various types of businesses like for electronics, steel, pharmaceuticals, education, information, entertainment etc. Currently, commercial deals are concluded on the net but payments are not transacted on the net in any great volume. That is because of the issues of security, authentication, digital signatures, digital documents and so on. The culture of credit cards, and electronic fund transfer is only recent. However, the number of starts-up in this regard is going up month after month. At the same time there is a furious merger and acquisition of activity. Two payment gateways are being set up (as of September 2000: due for commissioning by January 2001). The Indian currency, rupee is not convertible. That is an inhibitor of e-commerce on an international scale. There are at least half a dozen country-wide e-commerce facilitating private companies. ***Government allows 100% foreign ownership*** of e-commerce companies India's growing globalisation and increasing trade are great accelerators of e-commerce. The essential requirement for growth of Internet and e-commerce and applications are the existence of abundant and inexpensive bandwidth and PCs. The country's latest policies facilitate the build-up of bandwidth. There could be two varieties of information infrastructure providers. (a) Those who simply lease out dark fibres and (b) those who create bandwidth on them and lease out the bandwidth. These are the utilities - railways, the electricity and gas companies. Then we have the service companies for local-telephone; intra-state-telephone; interstate-telephone and international telecoms. Of course these distinctions are technical absurdities and are being undermined very fast. The new licenses being given are technology-neutral and therefore the implementors that are service providers can be expected to offer a variety of services on the infrastructure owned or leased.

ISPs and E-commerce companies can (a) be landing and maintenance companies for submarine cables, ending the state monopoly in this regard and (b) these can lease transponder capacity from any satellite/submarine cable systems.

The country has over 4 million PCs; last year we sold 1.3m PCs. The MIT is working with industry to bring out Internet connecting multimedia PCs for US $ 450 a piece. Such inexpensive availability will spur e-commerce. A foreign company is specially targeting small and medium enterprises (SMEs) for e-commerce; that promises an explosive growth.

5. TELEMEDICNE/HEALTH

A beginning is made to utilise computers and communications for telemedicine. It is only recently that corporations are delivering medical services in India. Several such corporations are computerising their working and are also acquiring various computer-based equipments. They see a great future as well as a business opportunity for telemedicine. One pioneering company has established a primary health and medical centre in a rural area (in Andhra Pradesh, over 400 km far from the sate capital Hyderabad) and posted a few trained medical attendants and undergraduate non-specialist doctors. The centre is linked to Hyderabad through Internet as well as a broadband leased circuit. While a few tests and prescriptions are made in the local centre, medical expert specialists in Hyderabad are able to read X-rays, take the pulse and examine the results of various locally taken tests on the computerised system; interrogate the patient and prescribe medicines. The Statewide Area Network (SWAN) in the State of Andhra Pradesh is being used to instruct students in medical colleges. Live operations in one hospital are shown in distant class rooms and the operating doctors explain to and interact with the students and professors watching the operation in distant hospitals/class rooms.

A number of corporate hospitals in the progressive states of Andhra Pradesh, Karnataka, Tamil Nadu and Delhi would be deploying telemedicine systems in the next 12 to 18 months. One Hyderabad Company is planning to have 1000 telemedicine centres and clinics spread all over the country and all of them are being planned to be connected through a satellite network to its specialist hospital in Hyderabad.

6 IT for the Masses:

Government of India constituted a committee "I.T. for Masses". Its recommendations cover among others, computer education in schools, monetary incentives for companies which deploy I.T based services in rural and remote areas, creation of content useful to farmers, artisans, village industries, ***specially low rates for Internet access and use etc.*** With the corporatisation of the DoT and more for full scale competition in telecoms, automatic approvals for foreign direct investment and hundred percent foreign ownership for e-commerce and infrastructure only companies, the use of and benefit from IT to classes and masses alike would be increasing phenomenally. IT would be the engine that pulls India into the information/knowledge society, the third phase in mankind's evolution upwards. (words 4,340)

Back to proceeding page **Back to the sessions page**

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4. He is the author of several books. A few of which are:-

Are you listening?

(The story of his struggles in the Dept. of Telecommunications to restructure it, deliver service and not merely administer Rules)

Issues in Telecom De-Monopolisation in India

P-Telcos in India-Why did India get them so wrong?

Back to proceeding page **Back to the sessions page**

Sign Language Users and Visual Communications:The *Deaf Australia Online* Projects

Claudia Slegers and Janice Knuckey

Abstract

http://www.circit.rmit.edu.au/

Introduction

Sign language users comprise a sizeable minority of the world's population. Estimates of the American Deaf community range from 100,000 to 500,000 (Grimes, 1996-99) upwards to 2 million people (Lane et al, 1996), whilst Australian sign language users number some 15,400 (Hyde and Power, 1991) [2]. In the 1960s the American linguist William Stokoe was the first to prove that sign languages are complete natural languages with their own rules of grammar and have autonomy in structure from English and other spoken languages (Komesaroff, 1994). Signing Deaf people are striving to be recognised as cultural and linguistic minorities within their broader hearing cultures, and not as a disability group (World Federation of the Deaf, 1999; Lane et al.,1996). Australian Sign Language (Auslan) is recognised as a community language under Australia's National Language Policy (DEET, 1991).

The *Deaf Australia Online* projects resulted from concerns about the Deaf community's limited access to and use of the current range of online services. To date most online services cannot be used effectively by sign language users, in Australia and indeed across the world, because they are based on sound and/or text: text is often problematic for Deaf people because of limited literacy in spoken and written languages such as English [3].

Conducted in 1999 and 2000, the *Deaf Australia Online* projects empirically examined how signing Deaf Australians use a range of communication channels (traditional and online) for daily life activities. Online services and actions were identified to complement and enhance the existing ways Deaf people do these activities. A number of new visual communication services, including a multi-function desktop unit, are now being trialed with Deaf participants in the second of the two projects, called *Deaf Australia Online II*. Both projects have been funded by the Australian Federal Government's *AccessAbility* program, which aims to make online services more accessible for people with disabilities.

These projects are clearly relevant to social policy principles of equity of access to online services by all citizens. However they also demonstrate leading edge development of online visual communication services which should be attractive to both industry and government in Australia and internationally: here is a community group that requires visual communication capability and can show its advantages in practice. In contrast, communications industries have been promoting the benefits of various forms of interactive broadband services for some time, without real market appeal. The trials provide a potential channel of development for more general services, by pursuing the technical and practical requirements of the Deaf community.

Both projects have been conducted by a consortium of Deaf community organisations, research centres, and service providers: Australian Association of the Deaf; CIRCIT at RMIT (Centre for International Research on Communication and Information Technologies); Australian Communication Exchange; Centre of Excellence for Students who are Deaf and Hard of Hearing, Northern Metropolitan Institute of TAFE; and Victorian Deaf Society.

The next section of this paper will discuss the 1999 *Deaf Australia Online* project, focusing on the use of online services by signing Deaf people and the services identified as desirable for this group. The subsequent section will discuss the trialing of visual communications services by Deaf people through the 2000 *Deaf Australia Online II* project, with particular focus on the multi-function communications unit trial.

Use of Online Services by Signing Deaf People: The *Deaf Australia Online* Project

The project *Deaf Australia Online* was a result of concerns about Deaf Australians' access to and effective use of online services. The aim was to go beyond increasing Deaf people's access to existing (often hearing-focused) online services via awareness raising and skills development. Rather, the multi-disciplinary team worked towards an ideal model of online services and actions by coupling understandings of the technical possibilities with understandings of the Deaf user's perspective. A development path towards that ideal model was identified.

Eight focus groups (with a total of 60 Deaf people) were conducted across Australia. Each group was composed to be homogenous in preferred mode of communication following similar Deaf focus group studies [4]. The sample of 60 covered a diversity of other characteristics such as age, ethnicity, gender, and geographical location, in the absence of statistics on the composition of the Australian Deaf community with which to ensure a representative sample. Deaf participants were recruited via a snowball sample using personal and professional networks of the researchers, including state and national Deaf society networks. The focus groups examined how Deaf people use a range of communication channels, including face to face interactions with sign language, telephone typewriter (TTY) [5], fax, email, and telephone relay service [6] for activities of daily life. These activities included personal communication with friends and family, study, and shopping. The interviews, conducted in Auslan, were transcribed into English and the data was analysed using qualitative analysis techniques.

The qualitative study showed that Deaf people, like their hearing counterparts, use a mix of communication channels across their activities and interactions with (Deaf and hearing) people. However a strong cultural preference for face-to-face communication and sign language exists across all the activities explored, from personal communication with friends, to shopping and interacting with government. One interviewee, Carla [7], explains:

> *I always prefer to meet someone face to face, especially if it is a friend who is having some sort of a problem or they want to express something emotionally. When I'm on the TTY I feel like I want to jump through to the other end of the line and actually see that person.*

For Deaf people it is particularly important to be able to use their first language, sign language, to express emotions and be understood well. But even without sign, face-to-face contact is seen to provide a sense of control and authentication, especially in high-risk activities such as banking. That Deaf people need *to see* to understand shapes many of their cultural practices, from ways of passing around news via meetings, to long drawn out leave taking rituals. Within Deaf culture, eye contact is much more intense and prolonged and it is considered rude to look away from a person who is signing (Carty, 1993). Moreover, facial expression is an important component of sign language, helping to convey subtle shades of meaning in the same way that hearing people use voice tone and quality.

Text-based services such as email, TTY, and telephone relay services are avoided by many Deaf people because of difficulty using and understanding English text, their second language. However those with relatively high levels of English literacy are more comfortable with such services. Deaf people are very positive about visual communication channels that support sign language, such as videoconferencing.

Deaf people, like their hearing counterparts, tend to use communication channels that their friends, family and other contacts can also access and use. It was recognised that online services identified as desirable through the project would need to interconnect with technologies already being widely used, such as the TTY, fax and email. However many Deaf people have a number of communication technologies cluttering up their lounge room or kitchen, and a preference exists for a range of communication channels (such as interactive text, video and fax) to be available in one unit. Says Kim,

> *We have our computer, we have a TTY, we have a fax … If you could fit them all into the one device it would be great, rather than having a huge bench with all these devices. You need so much space. If they could all be combined into one device it would save so much room and the place wouldn't look crowded.*

The mix of communication channels used by Deaf people is also influenced by the fit between characteristics of the channel and the requirements of the activity. For example many Deaf people use the fax to set up meetings with a friend because the particular activity (setting up appointments with friends) can be done speedily and does not require a strong sense of emotion. But when they want to communicate with a friend about a more complex issue, then a face-to-face meeting is preferred.

Other issues such as awareness of new online services, trust and control of information and payments, and skills were also identified in this first project. These were taken up by recommendations which cannot be dealt with in this brief paper focusing on the services identified, but are discussed in the final report (Vicdeaf et al, 1999).

Using these insights, the *Deaf Australia Online* project team identified desirable online services for Deaf people. These services are:

- Multi-function communications unit: a PC-based unit enabling choice of communication channels such as videoconferencing, email, fax, Web access, and TTY, as well as the usual PC functions. With the addition of a telephone handset, a general unit of this nature might be used by both the hearing public and the Deaf community.
- Mobile unit combining messaging, email, fax and TTY
- Sign language video clips on the Internet: for the provision of government services information.
- Public videoconferencing: special purpose - for example, for education applications - and available for general communication use, including video relay interpreting.
- Video-relay interpreting: utilises a sign language interpreter to relay calls between Deaf users and hearing users without the use of a TTY. The Deaf person communicates with the interpreter via a two-way video link using compatible equipment, whereas the interpreter and the hearing user communicate telephonically. It could also be associated with the multi-function unit or a more public videoconferencing service.

The capability for visual (video) communication for sign language is fundamental to a number of the proposed online services. Preliminary technical investigations uncovered a range of videoconferencing and videophone products and services, with some specifically purporting to be of value to the Deaf community. However, effective signed communication requires high capacity ISDN or similar transmission infrastructure, which is currently very expensive. In the medium to long term such costs may fall with the use of other transmission technologies, including wireless, and cheaper terminal equipment. Standards and interoperability issues are also key to further development.

Preliminary investigations concerning the multi-function unit were unable to uncover any fully developed units of this nature. A prototype unit was, however, being developed in Sweden as the *Allan* unit. Linked activities with its developers and associated trials would provide a channel for gaining experience.

The 1999 project recommended that greater practical experience is needed of the approaches to meeting requirements of the Deaf community, through trials of existing products/services or prototypes.

Leading-edge Use of Visual Communications Services: the *Deaf Australia Online II* Trials

The new project in 2000, called *Deaf Australia Online II*, involves conducting trials of the online services identified in the earlier research. With Deaf participants, the project is evaluating effectiveness and usability of the services for a range of activities. Feasible locations are being determined for technologies in the home, workplace and community centres. Technical evaluation of the services is focusing on inter-working, standards, bandwidth requirements, terminal specifications, and expected costs for set up and ongoing operation.

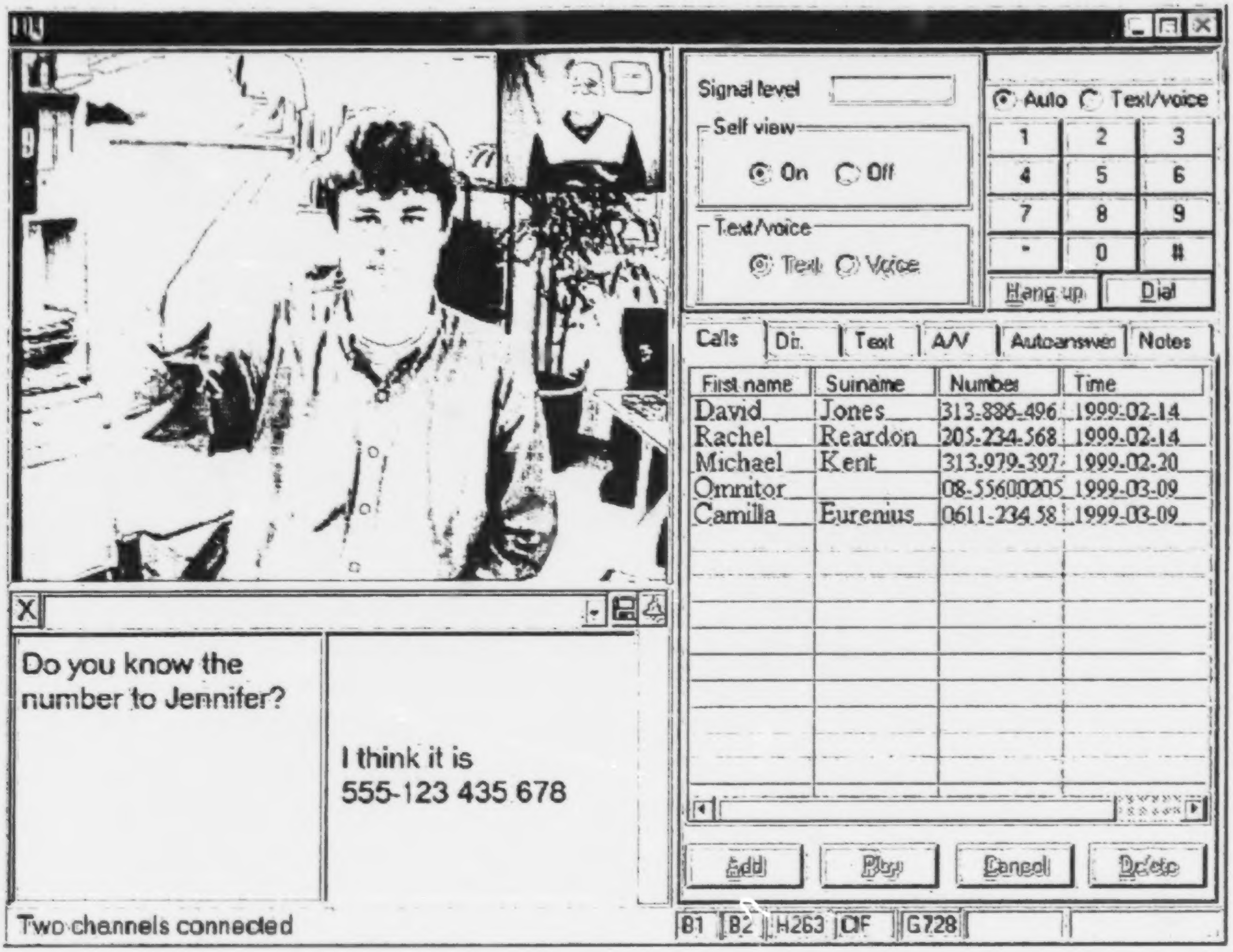
This section will discuss the trial of a multi-function communications unit. Technical evaluation, and evaluation of use and usability, will be discussed respectively below.

Technical evaluation of a multi-function unit

The Allan-10 unit is a PC-based multi-function unit that enables communication via video, text or voice, and these can also be used simultaneously during an interaction. Developed in Sweden, the unit offers communication between Deaf people, as well as between Deaf and hearing people and between hearing people. The Allan unit could be ideal for home or work-based communication.

The 'unit' itself is really just a video card, a text card, a video camera, and associated software connected to a standard desktop PC. When set up the unit looks like any other PC but with a small camera on top: the screen contains a picture for the videoconferencing image (such as the person at the distant unit) with menu information on the right hand side. Figure 1 below shows what the screen looks like.

Figure 1: User interface of the Allan-10 unit



● Auto ○ Text/voice

Self view: ● On ○ Off

Text/voice: ● Text ○ Voice

Do you know the number to Jennifer?

I think it is 555-123 435 678

First name	Surname	Number	Time
David	Jones	313-886-496	1999-02-14
Rachel	Reardon	205-234-568	1999-02-14
Michael	Kent	313-979-397	1999-02-20
Omnitor		08-55600205	1999-03-09
Camilla	Eurenius	0611-234 58	1999-03-09

Two channels connected

B1 B2 H263 CIF G728

Source: Omnitor AB at: http://www.omnitor.se/english/products/user-interface.html (accessed 25/8/00).

The Allan-10 unit requires a basic rate ISDN (Integrated Services Digital Network) connection at 128 kbps, rather than the PSTN. The unit can interconnect with text phones such as the TTY. It can also be used as a voice phone, and separately for multimedia, general PC usage and Internet access. Importantly, all modes of communication can be undertaken simultaneously.

By conforming to International Telecommunications Union (ITU-T) standards, Allan-10 units interwork with other products also designed to ITU standards, though the full simultaneous functionality and usability may only be available if communicating with a like unit. The applicable standards are: H.320 (ISDN-based videoconferencing), H.261 and H.263 (video coding), G.728 (speech coding), T.140 (multimedia application text conversation) and V.18 (text telephony).

As part of the *Deaf Australia Online* trial, a pair of Allan-10 units were first interconnected via 128 kb/s ISDN and operated side by side within the one room so that each could be configured in an identical fashion, cameras properly focussed, all interworking functions tested and video and audio delays observed. The Allan-10 is designed to deliver the following minimum performance suitable for usable signing:

- A video frame rate of 12 frames per second;

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- A picture quality to CIF (Common Interface Format) standard, providing a resolution of 352x288 pixels; and
- Picture delay of less than 1.2 seconds.

The hardware and software for each Allan-10 costs about $AUD6,000 [8], once initial approval has been has been gained from the telecommunications regulator. Orders in larger quantities would be expected to be cheaper. Each PC costs about $AUD2,500. The current cost of a 128 kb/s ISDN service from Telstra ('OnRamp 2') includes three components:

- A connection fee of $AUD325;
- A rental of $AUD55 per month; and
- Data usage (ie. for video conversations) of about $4/hour for local calls.

Evaluation of use and usability of the units with Deaf sign language users

The units were placed at two Deaf community organisations in Melbourne (Victorian Deaf Society and Victorian Services for Deaf Children) for the duration of the trial. These locations were chosen because many Deaf people attend each week for various cultural events, services, meetings and education. The sample of 16 interviewees was composed to include a mix of preferred modes of communication (primary Auslan users with high and low levels of English literacy and 'oral deaf') and to represent a diversity of gender, age, and ethnicity. The sample was consciously overweighted to those with *some* technology experience with computers and use of TTYs so that use of this computer technology could be best evaluated. Participants were recruited via a snowball sample using personal and professional networks of the researchers.

The data collection methods of this evaluation are summarised in Table 1 below. A mix of methods was used to test and verify findings across the different methods. Each participant was individually interviewed prior to using the unit, then given a brief training session by the interviewer on how to use it. Following the training (usually about 15-20 minutes duration), the participant was asked to carry out two or three activity scenarios with a Deaf researcher at a second Allan unit in another location. This helped explore the applicability of the unit for a wide range of activities, such as workplace communication, personal communication with friends, and interactions with businesses. Following this use of the unit, the participant was then interviewed about their views of value and effectiveness of the unit for various activities, and about transmission of signing, features of the unit, and future use. After intervening (and unsupervised) use during the following month, a focus group of some participants was conducted to capture views emerging after more extensive use of the units.

Table 1: Methodology for evaluation of use and usability of multi-function unit

Usability evaluation activities	Purpose
Individual interviews prior to use	Collect demographic data, household access to communication technologies, experience with technologies, expectations
Brief training session	Teach participant the basics of using the technology so they can evaluate it

Activity scenarios with observation of use	Examine what activities and applications are these technologies most appropriate for
Individual interviews post use	Collect data on value and effectiveness of technologies straight after use
A focus group following further use by some participants (a few weeks after the first series of interviews above)	Collect data after more in-depth use and time to reflect further.

Interim findings on use and usability of multi-function units

Deaf participants have been very excited by the potential to communicate using their first language, Auslan, from the home and workplace with their Deaf friends, family and work colleagues. The unit's video capability is seen as a huge improvement over text communication such as TTY, fax or email, which to date have been common modes of communication between Deaf people over distance. Deaf people see the benefit in being able to express emotion and subtlety through their first language in a similar way that hearing people can with voice quality and tone on the telephone. As Pamela explained,

> *Auslan is our visual language, and the Allan unit provides a way for us to communicate visually with Auslan… I really liked the fact that I could see the other person's face and their expression. With the TTY we have to add exclamation marks and question marks to convey expression, but through the video unit we can see the expression visually.*

Although participants have been able to express and comprehend sign language with their Deaf interlocutor at the other end, they have commented that signing appears slightly stilted or jerky sometimes, especially finger-spelling. In these instances, they have had to ask their interlocutor to repeat what they signed a little more slowly or to type it using the text facility. The clarity of the video picture has generally been very satisfactory to participants, with blurring only occurring during periods of fast finger spelling. The contrast in picture between light and dark has been generally very satisfactory.

Given that most Deaf people already have a wide range of communication technologies cluttering up the home (TTY, fax machine, computer) participants have expressed enthusiasm about having different communication modes in one PC-based unit. One interviewee commented,

> *[The multi-function unit] is better than having a long bench with a computer with email, a fax in the corner, and my TTY on my right. I currently have to coordinate the use of these different machines and juggle things somewhat. My fax is a little bit out of reach. If I had everything in the one unit it would be all very accessible.*

Deaf people see value in using text to supplement signing for some activities, for example when wanting to distribute a list of names or figures for work or a party, for phone numbers and addresses, or for just clarifying a fingerspelled word that was not understood. Participants also like the opportunity to keep a record of these kinds of text interactions for later reference. They also see the value of having access to TTY in the unit, for communicating with all the Deaf people who would not have access to such a unit in the near future.

Having each had about 15-20 minutes hands-on individual training, Deaf participants have expressed comfort and confidence with using the PC-style interface of the unit for a variety of interactions. Even those who had scarcely used a computer before were comfortable with the interface, recognising that an interactive session using the unit requires minimal use of a mouse and keyboard. Most Deaf people would require hands-on training in use of the unit by a Deaf trainer or someone who is otherwise fluent in Auslan. The training would best be offered by organisations known and trusted by the Deaf community, and those that have a successful record of training provision in the past, such as Australian Association of the Deaf and Australian Communication Exchange.

To test the unit's applicability across a wide range of applications and activities, participants have conducted mock interactions, including personal communication from the home with Deaf friends and family, workplace communication with Deaf colleagues, as well as with Deaf teachers and service providers such as Victorian Council of Deaf People, Vicdeaf, and Centrelink. The participants see particular value in such a unit for home-based personal communication and for workplace communication. Importantly, the technology is seen as mainstream, readily usable by both Deaf and hearing people alike, and hence adhering to principles of universal design.

Not surprisingly, the present costs of the software for Allan-10 and the ISDN transmission have been recognised as major barriers to future access and use by Deaf people. Software and equipment costs are unlikely to fall without mass production, which implies the wider acceptance of such videoconferencing within the hearing community. Such a unit could be targeted to industry for application by small businesses, teleworkers and in education, sectors which may benefit from such leading-edge desktop video communication.

Broadband transmission costs are unlikely to fall without greater competition between service providers coupled with a greater demand from users. However there is hope that third generation (3G) mobile telephony and ADSL [8] transmission technologies will offer such lower transmission costs and wider take-up. These issues regarding cost continue to be examined as the project nears completion.

A final report of the *Deaf Australia Online II* project will be delivered in early 2001 to the Australian Federal Department of Communications Information Technology and the Art's *AccessAbility* program, and subsequently made publicly available.

Conclusion

Examination of the use of online services by Deaf people has generated important outcomes on two fronts. Access to such visual communication services from the home and/or workplace will enable a linguistic minority to use their first language more widely and across distance. Application of such services for Deaf communities in other nations should be considered by policy-makers and Deaf communities alike. Moreover, the projects demonstrate leading edge development of online visual communication services with the potential for application to the wider community, particularly small businesses and teleworkers. Such mainstream adoption of visual communication is expected to be triggered by the widespread availability of more affordable broadband transmission.

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Endnotes

[2] The occurrence of limited literacy in spoken languages such as English is not just because English is a second language for sign language users. It is also because of a tradition of oralist education of Deaf children that has pervaded the western world for the past 100 years: oralist education involves the teaching of the oral production of spoken language, in this case English, whilst sign language is usually forbidden or discouraged. For Deaf people, unable to access the auditory form of the language as hearing learners can, learning to mouth the words and to lip read is a very slow intense process occupying most of the school day, leaving very little time for the learning of academic content (Lane, H. 1984; Lane, H., Hoffmeister, R., and Bahan, B. 1996). Bilingual education using sign language as the language of the classroom has been shown to teach subject matter better and impart background knowledge and skills that facilitate learning English (Lane, H., Hoffmeister, R.; and Bahan, B. 1996).

[3] Balch and Mertens (1999: 267) argue that the crucial criteria for composition within Deaf focus groups is homogeneity in preferred mode of communication and hearing status. Following this, each of our focus groups was composed of one of the following categories: Deaf people who primarily use Auslan, are highly educated and can read and write English; Deaf people who primarily use Auslan but with limited education and English literacy; and 'oral deaf' people who rely on oral communication (lip read by watching an oral interpreter who carefully enunciates speech instead of signing).

[4] Telephone typewriters, also called text telephones, are terminals used for two-way text conversation over a telephone line. They are the primary tool used by Deaf people (and some hard of hearing people) for telephone conversation in many countries

[5] Telecommunications relay service provides a bridge between people who communicate by voice only and those who communicate by TTY (with or without a voice component). TRS is designed to allow real-time conversation by providing third-party assistance at no cost to the users. A trained communication assistant speaks the words typed by a TTY user, and types the words spoken by a voice telephone user. In Australia the relay service is funded by the Federal government and run by the Australian Communication Exchange. In the United States the relay service is mandated by the Americans with Disabilities Act, and is regulated by the Federal Communications Commission

[6] Names of interviewees are pseudonyms to preserve confidentiality.

[7] One Australian dollar equals 55 U.S.cents on 15 September 2000.

[8] ADSL is the acronym for Asymmetric Digital Subscriber Line

Back to top of page **Back to the sessions page**

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As Associate Research Fellow at the Centre for International Research on Communication and Information Technologies (CIRCIT) at RMIT University, Claudia Slegers has been researching the use of information and communication services, particularly in the residential and business sectors. In 1999 Claudia jointly coordinated the national project *Deaf Australia Online,* funded by DCITA (Dept of Communications, Information Technology and the Arts), which examined the use of online services by the Deaf community and identified desirable services. Claudia has conducted national surveys on small business use of online services and in-depth qualitative studies of residential users. This work has helped produce the publications listed below.

Claudia's publications include: *Trust and Electronic Money </publics/prp97.html>*, 1997, (with Supriya Singh) CIRCIT Policy Research Paper No. 42; *The Story of Small Business and Electronic Commerce <publics/prp98.html>* 1998, (with Supriya Singh) CIRCIT Policy Research Paper No. 43; *Small Business and Electronic Commerce: An Australian Survey <publics/rr99_98.html>*, 1998, (with Supriya Singh) Research Report No. 22; *Use of Communication Services by Deaf Australians*, 1999, (with Janice Knuckey), Presentation to Australia's Communications Research Forum, 27-28 September 1999, Canberra, and *Discourse Strategies of Deaf and Hearing Australians in the Workplace,* 2000, Proceedings of ALS2k: The 2000 Conference of the Australian Linguistic Society (forthcoming).

Claudia is currently completing her Masters Degree by research in Linguistics at La Trobe University. This involves researching communication patterns between Deaf and hearing Australians and their use of online services. Claudia also has a Bachelor of Arts Degree in Social Sciences and a Graduate Diploma in Social Survey and Research Techniques from La Trobe University.

Back to proceeding page **Back to the sessions page**

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In 1999 and 2000 Janice jointly coordinated the national research projects, *Deaf Australia Online* and *Deaf Australia Online II* which were funded by the Department of Communications, Information Technology and the Arts.

In 1999 Janice co-authored research projects New and Emerging Learning Technologies for Deaf and Hard of Hearing Students in VET with Judie Kay and Lorna Lawford and in 1998 The Feasibility of Online Training for Deaf and Hard of Hearing Students also with Lorna Lawford and Judie Kay. These projects were funded by National Centre for Vocational Education Research and Open Training Services respectively.

Back to proceeding page   Back to the sessions page

The Dilemma of Digital Delivery: Assuring Access to Digital Resources as Technologies Change.

Carole A. Alcock

Abstract

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Introduction

Effective access to digital resources is the challenge for the next decade. While emerging technologies promise greater access to information, there is an obverse side to this promise. As electronic resources displace technology independent media such as paper, digitally stored information becomes vulnerable in ways that may defy solution. Indeed, these resources are vulnerable to the very changes embodied in the new technologies. This paper discusses problems arising from the move to digital access. In particular, it suggests that if new standards are not established for the storage and maintenance of resource collections, the advantages of electronic delivery will be lost. While the initial focus is on libraries and public records agencies, this problem is not unique to those sectors. It is one which must also be addressed by business and industry: that is, by public and private sectors alike.

Changes in technologies, which affect delivery, mean that, for some digital resources, permanence can no longer be guaranteed. Libraries have been among the first to confront this problem. Whole collections are being set up which are dependent on digital resources. "The Digital Library" has long been a popular theme for discussion among forward thinking library and information professionals. Now, even quite small libraries can access digital media. Developments in the telecommunications industry have facilitated this move to electronic delivery of resources. Where links to remote collections are concerned, the issue may be hidden. It is the central repositories of electronic media where problems will arise first, and this will affect everyone with an interest in accessing those resources.

1. The problem

The ease with which records can be copied and changed, means that, for some records, permanence can no longer be guaranteed. However, this is not the main reason for concern. Changes in software and hardware are occurring so rapidly that some records may not make the transition from one system to the next. While, for the more ephemeral records this may not be important, there are many areas, in business, industry, and research, where it will be essential to retain access to electronic resources stored on media only accessible through older systems. Access might depend not only on retaining the records themselves, in whatever storage media, but also multiple versions of software and even hardware. If standards are not in place for the migration of records, the advantage of electronic storage will be lost.

In his discussion of approaches to information management, Bentley [1998] emphasised the importance of completeness and correctness of information, the prevention of deterioration and avoidance of accidental loss and corruption. One of the advantages of today's technology is that we expect that digital copies will not be degraded, that they will be the exact same as the original. While this may be so initially, with the passage of time, changes in software, hardware, and systems, degeneration may occur in digital copies, too. Bentley also pointed to the risk of dependency on Information Systems. Witness the panic over the Y2K problem. This demonstrated society's dependence and the interdependencies of organisations on computer systems. One of the positive aspects of this crisis was that it forced businesses to undertake inventories of critical systems [Manion & Evan: 379] and to recognise the importance of IT systems and resources to strategic decision-making. If access to resources is lost or corrupted, business will suffer.

The Y2K experience also made businesses aware of their interdependencies both within and outside organisations and across national borders. Ohmae emphasises this importance of the flow of information among countries and the change that has occurred. Information once monopolised by governments is now accessible to individual citizens [Ohmae: 18-19]. He speaks of global citizens who have their own sources of information and are no longer dependent on government sources. While dependency may have shifted away from governments, access to information itself will remain essential to well functioning businesses and societies. Indeed, without the guarantee of protection and safeguards that governments can provide it is even more important to ensure the longevity of those resources essential to continuing development.

A useful overview of the issues relating to the topic of digital preservation has been provided in an article by Mitchell Parkes[1999]. One of the more significant issues he addresses is that of technological obsolescence. This issue is one which should be of great concern. To illustrate this, one example given is that of the 1960 US census which was stored on magnetic tape [Parkes:362]. By 1976, the equipment needed to read this tape was no longer available at the Census Bureau, and only two such machines survived: one in Japan and another in a US museum [Parkes:362]. The information the tapes contained was of significant historical value to the National Archives. Fortunately, a copy was able to be made which did allow long term preservation [Parkes:362]. This is just one example but it illustrates the problem. While much focus has been on the physical storage media itself, the problem of technological obsolescence should be of far greater concern. Parkes indicates that this view is strongly backed by the literature [Parkes:363].

2. Who is affected? (Libraries, Archives, Business)

Efficient record storage and retrieval is essential to business success. To meet commercial and statutory requirements, information has traditionally been stored in hardcopy media such as paper or microform. To maximise the benefits accruing from the exponential growth forecast in electronic trading, organisations will become increasingly dependent on electronic forms of transaction records. Archiving of these records in a manner that ensures access for the future thus becomes a matter of serious concern.

The external resources that business use are also being affected. Denison's and Stewart's *Electronic sources of information for business in Australia and New Zealand*: (3rd ed: 1998-1999), presents a comprehensive list of electronic sources for business including a mix of 'stand alone' media like CDROMs and web and traditional online database resources[Denison and Stewart]. This is a rapidly changing field with many of the traditional electronic resource providers experiencing considerable pressure to keep up with the demand from business to provide more flexible, accessible and affordable electronic resources in line with the heightened expectations that Internet access has produced. Many of these services existed in some form before Web access was generally available and have had to adapt to the new technologies in order to maintain their business market.

Libraries, too, are expanding their reach and the extent of the resources they provide in digital form. Kessler [1996] has described the spread of Internet access to libraries, focusing on access to digital resources. In the Pacific region, countries covered include Japan, China, Australia and Indonesia. Clearly, this is a rapidly changing field. Certainly, in Australia, the breadth of electronic resources available through libraries has grown enormously since the publication of Kessler's book. The concern, as elsewhere in this paper, is that the resources provided will continue to be viable as technologies change. This is a continuing problem for libraries who experience a great diversity of demands in terms of the media, software, hardware, through which digital resources are provided/delivered.

These problems of storage and accessibility are not new, of course. Storage has progressively become more difficult for libraries and many solutions have been taken up culminating in the current computerisation of collections including the scanning of books and the provision of computer terminals throughout the library. These, too can consume space and libraries at present are combining both computerised access and maintaining hardcopy resources for those still reluctant to use the new media.[Petroski: 212-214] Remote access has problems, especially where copyright may restrict distributed access. It may be some time before libraries can be fully accessible remotely, thus overcoming some of the continuing physical storage problems.

Nevertheless, libraries are addressing the problem and have much to contribute. There is an awareness of the difficulties in archiving electronic documents, particularly if they are dynamic as, for example, web pages[Rowley: 16-17]. Which version should be archived? Deciding what constitutes a document and providing bibliographic control also present problems. Other questions that have been raised include:

What data should be archived?
Which storage media should be used?
How long will the database last without deterioration?
How can individuals access archived databases?

These are not issues of exclusive concern to libraries. Most people are familiar with this problem of archiving, if only on a small scale. System software upgrades, hardware changes, moves to a different e-mail system, all can cause problems where access to files are concerned. In the business sector, such changes may cause problems which have legal and financial ramifications for the company.

3. The past (examples)

The difficulty of access to large collections of information resources is not new. Negotiating today's web of digital information has been compared with the labyrinthine stacks of the monastic library described in Umberto Eco's *Name of the Rose* [Alexander: 23]. Access was not the only concern of that period. Previous to the advent of the printed book, the degeneration of content, both text and pictorial, of hand-copied manuscripts was a common problem to the extent that classical authors warned against relying completely on their content [Eisentstein: 194-195]. Errors were inevitable. One of the perceived advantages of today's technology is the expectation that digital copies will not be degraded, that they will be the exact same as the original. While this may be so initially, with the passage of time, changes in software, hardware, and systems, degeneration may occur in digital copies, too.

4. What is being done? (Libraries, PROs, Business - storage)

Governments are moving towards greater dependence on electronic data storage and hence are already engaged in digital archiving projects. While their requirements may differ from those of the business sector, there are still benefits to be gained from a study of current digital archiving projects to establish where there is overlap and to establish the extent to which these projects have dealt with the problem of changing technologies and changing format requirements.

Some research into digital archiving is well established in the field of government and in libraries. The Victorian Government in Australia, for example, recently notified its whole of government approach to electronic records keeping. The Victorian Electronic Records Strategy (VERS) Project was aimed at enabling Victorian Government agencies to implement satisfactory electronic archiving systems and strategies which would facilitate long term accessibility. Other studies have been conducted. For example, the US National Historical Publications and Records Office funded a project at the University of Pittsburgh in 1995. Another study, *Preserving Digital Information,* was conducted by the US Commission on Preservation and Access and the Research Libraries Group (1996).

A project of interest at the UK Public Records Office at Kew is EROS: Electronic Records in Office Systems (UK: Cabinet Office. Central Information Technology Unit's Government Directive Initiative: Digital Records. August 1998). The role of the Public Records Office (PRO) includes the electronic preservation of government records. The EROS Web site [see bibliography] gives information on this project. Some examples of the records kept on this system (viewed at the PRO in 1999) included: (i) Committee proceedings, notes, attendees and (ii) Drafts of a Green Paper. The latter was presented in pdf format. Dates allowed movement back and forward to various versions of document (dates indicated changes made).

Large scale data storage functions have been undertaken by Oxford University Computing Service which Archives electronic assets of University of Oxford [Feeney: 34-35]. The University of London Computing Centre provides a databank for a variety of depositors including the Public Records Office. Work is undertaken on a contract basis, with management of data at the bit stream, on a 'cost for quantity' economic model. The Computing Centre's core service is as a 'Safety Deposit Box' [Feeney: 37-38].

Clearly, for governments and the library sector this is matter of serious concern. For the business sector, where access to records is a matter of financial survival, tackling this problem is essential. Businesses are attempting new ways of dealing with the expanding need for digital storage. One example is the Media Asset Management (MAM) systems which aim to provide faster retrieval of digital assets (graphics, illustrations, page layouts, and compound documents which may include movies and sound, etc.) and create metadata characterising the particular asset [Anon.: 1998]. In order to get the most out of these systems it is recommended that digital assets first be organised in folders or binders in much the same way as for paper documents like letters and faxes. It is suggested that not doing anything about media asset management isn't an option as the problem will only get worse [Anon.: 1998]. While this is an example of the concern over digital assets which focuses on access, the need for organisation of resources and for appropriate metadata, the compounding problem of changing software will still need to be addressed.

Storage is another area where changes are occurring. Annual growth rates for storage provision have been reported to be more than 60%. Storage management costs were rising by 25% p.a. Hence the growth in outsourcing to Storage Service Providers (SSPs). These could be viewed as information utilities allowing faster rollouts of new applications, improved security, backup and data archiving[Moore:1,24].

Enterprise Storage connects to, stores and retrieves data from all major computing platforms in both mainframe and open systems environments. It also allows connection to networks, file servers, Web servers and management interfaces. Consolidation of data is facilitated and managers are able to leverage information from throughout the enterprise.

Enterprise Storage Network (ESN) [Rich, 2000] ESN provides a single infrastructure which exploits the power of information. It is independent of location, cost effective, flexible and provides easy scalability (up or down). Other aspects include: cross-platform connectivity, transparent and non-intrusive data migration and data-centric storage architectures. ESN presents particular advantages in merging organisations[Rich, 2000].

It is clear from the above examples that there is some overlap in the concerns of the public and private sector organisations in their focus on data migration and data storage. Indeed, some have pointed to the idea of the web as a distribution system for content and suggested the prospect of its developing into a distributed system to enable migration of content [Evans: 1999]. While approaches may differ, there are surely benefits to be gained from both contributions.

5. Proposed solutions (Migration, archiving the technology, emulation, standards)

Proposed solutions to ensure access include: archiving the technology, migrating content as systems and software change, saving data at the bit stream and using emulation software as required [Rothenberg: 24-29]. Archiving the technology is unrealistic although it is conceivable that there may be a role for this to some degree. In the summary provided in Parkes, solutions focus was around three areas: migration of data; emulation; and standardisation.

Migration involves not only transferring the data to the new media but ensuring that the necessary modifications have been undertaken to maintain compatibility with the new technology [Parkes: 369]. Exact copies can not be guaranteed, however and the task may involve some complexity [Parkes: 369]. Most regular users of word processing and presentation softwares would be familiar with the problems involved in migrating basic documents as software packages are upgraded! Indeed, the US Task Force on Archiving Digital Information (1996) noted that migration is 'time consuming, costly and much more complex than simply refreshing' and did not favour this method [Parkes: 370].

Emulation: Rothenberg's proposal to provide software which emulates the original hardware and software environment is discussed [Parkes: 370]. While this method has received some favourable reviews, it is suggested that many of the same problems are evident here as for migration, among them the economic feasibility of continually producing emulation software given the speed of technological change.

Standardisation: Again, Rothenberg's work is referred to [Parkes: 371]. While preservation in a computer system independent format may be suitable for some content, problems arise if structure is an important element [Parkes: 371]. This may be one reason why pdf format documents have been favoured by some digital preservation projects.

Victorian Electronic Records Strategy (VERS) was a joint project of the Public Records Office of Victoria and the CSIRO [PROV:1998]. Its aim was to provide good record keeping for government business with a focus on long term storage requirements. A successful prototype was developed with potential financial benefits. All government departments would be involved. Electronic records would be produced in long term format, captured at point of production. Standards established included: Use of XML; PDF; digital signatures to ensure integrity; standardised metadata [PROV: 1998]. Interest had been expressed from the business sector.

In discussions with researchers involved in some of the projects listed above and in others in the UK and Australia, it was agreed that none of the solutions offered a final answer. Problems with all of these include: practicality, costliness and loss of information.

6. Standards (XML, PDF, etc.)

In his discussion of the importance of XML, Berners-Lee points out that it 'stems the tide of information loss' because it allows anyone to create their own tags as they deem necessary[173]. Hence, 'An XML document is typically richer: the information it contains is more well defined.'[Berners-Lee: 173]. XML is favoured for these reasons by influential groups internationally (W3C) and seems to be gaining widespread acceptance.

Other potential standards have been indicated above, among them pdf, digital signatures and standards in metadata. The usefulness of pdf was noted in 4 above: Drafts of Green paper: The later was presented in pdf format. Dates allowed movement back and forward to various versions of document (dates indicated changes made). Although pdf relies on proprietary software, its broad availability and popularity and the popularity of XML certainly hold some promise for their being adopted as standards in the short term. The VERS project above included these among the favoured list of standards.

7. Recommendations (Procedures, the process)

While discussion of standards tends to consider the global context, local needs must also be considered. Joseph Stiglitz - Chief Economist with the World Bank, when discussing to the Global Development Network emphasised the importance of locally based research institutions which possess a knowledge of local conditions and needs. For this reason, global 'technological fixes' may never be adequate to meet the digital archiving needs of individual businesses. To some degree, the focus will need to be on procedures and processes which take into account local conditions.

For most organisations, the integrity and accessibility of electronic records is essential to the success of their enterprise. As has been suggested, the rapid changes to technology, changes in hardware and software for example, present difficulties where long term preservation is concerned. How to ensure the migration to a new system, of all records essential to the conduct of their business, is a perennial concern with no quick solution. What is needed along side the technical solutions is a set of policies and procedures which will guarantee that all essential records are indeed retained and are accessible and secure.

It will be important to develop a standard approach to dealing with record storage and retrieval within an environment of continuing technological change - for both software and hardware. One step should be the design of a process methodology which defines a uniform set of standards for adoption by the organisation, to enable the storage and retrieval of strategically important information.

The organisation will be well aware of the importance of guaranteeing that client records are not lost as records migrate for one system to the next and of the need to ensure efficient and effective access over the long term. A preliminary study of specific needs which covers areas such as commercial transactions, client information, financial record keeping, legal requirements and focuses also on the enabling technologies will aid identification of the essential procedural elements.

International standards are being developed as regards the use of metadata in providing access links between electronic media. It is important that these standards, especially as they relate to the specific needs of the organisation concerned, be considered when establishing procedures.

8. The Future (merging software, Data mining, Data warehousing, Knowledge Management Tools, Digital Archiving)

What is preserved is a matter of choice. What is remembered or revived depends on the priorities and values of a given group at a given time. Indeed, what has come down to us as classics from past centuries, as O'Donnell suggests, have been influenced by artificial imperatives. He illustrates this by pointing to the revival of the reading and copying of Latin classics at the time when Christianity became the official religion of the Roman state [O'Donnell: 109-110]. Undoubtedly, this selectivity was continued during the periods where expensive and time consuming manuscript copies were made in medieval libraries, usually in monasteries. Today, too, choices will be made as to what is to be preserved. The likelihood that much will be lost that, perhaps should have been preserved is real. Clearly, the changing technologies make that inevitable unless some simpler means for the digital preservation of resources is found.]

Approaches will vary in libraries as in business. Alexander emphasises that there is no one single technological solution to the provision of a digital library. 'There is no one means of creating and exploiting the digital library. It will be be based on a range of different technical approaches, and the particular approach used will depend on the immediate service requirement.' [Alexander: 20].

Established technologies such as data warehousing and data mining present a reactive approach often dealing with legacy systems. Newer Knowledge Management (KM) Technologies focus on current business needs. Much of the discussion around digital storage and digital archiving on the other hand, tends to be proactive and concerned with both current and future access. This is important. Descriptions of current developments in all of these, suggests a merging of technologies to a degree. However, assuring long term access to content through global agreements on standards may continue to be difficult to achieve.

Conclusion

Efficient storage of digital resources is an urgent concern for both private and public sector organisations. However, focus on storage alone is not sufficient. It is essential that the issue of long term access be addressed at the point of creation of the digital resource. Changing technologies, hardware and software will continue to present problems for long term access unless appropriate procedures are put in place to ensure that essential digital resources are preserved and continued access assured. The methods suggested to date: archiving the technology, migration of data, and emulation, all present problems of cost, practicality and loss of data. Today, the ability to store information is unparalleled. The wealth these stores contain is essential to our economic and social well being. This wealth is of little use, however, if we lose the key.

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Back to top of page **Back to the sessions page**

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My PhD thesis, completed in 1996, related to online information delivery in libraries. As part of the work for that thesis, I undertook a comprehensive survey of Academic and major Public libraries. More recently I have extended my research into electronic information delivery to include the experience of other public sector organisations and the business sector. The proposed paper draws on some of this research.

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Back to proceeding page **Back to the sessions page**

Sustainability and Training in the Community Telecenter Movement

Royal D. Colle and **Raul Roman**

Abstract

1. ICTs and the telecenter movement

Industrial nations making up the G7 group met in Okinawa in July 2000 and included on their agenda the issue of information technology for countries that appear to be substantially lagging behind in the Information Society. Appearing during the closing months of 2000 was the Okinawa Charter which lays out some general paths for the G7 nations to follow in alleviating the "digital divide."

The digital divide issue is about differential access to information and communication technologies (ICT). Today that usually means computers and the Internet. The divide is reflected in some recent ICT data from the UNDP's Agenda 21.

- 276 million people worldwide are using the Internet
- 200,000 devices (computers) are being added each day to the Internet
- 1.5 billion web pages have been created
- 2 million web pages are being added each day.

But, 95% of the world's population is not participating in this activity.

To provide that access to the "have-nots", a vibrant telecenter movement has emerged across the world, led by organizations such as the International Telecommunications Union, the Food and Agriculture Organization of the UN, the World Bank, USAID and the Canadians' IDRC.

Driving the telecenter movement *now* is the assumption by international donors that access to information contributes significantly to the development of communities - better health, education, environment and economic opportunities. *Just ahead* is the push by more commercial and business interests - illustrated by SOFTBANK Emerging Markets, a recent joint venture by the World Bank and Japan's SOFTBANK, which intends to "incubate Internet-related businesses in developing countries."

Various countries have taken steps to deal with their own digital divides. In the United States, increased access by people on the "wrong" side of the digital divide is afforded by government and private initiatives to put these technologies into schools, libraries and various other community public-access locations.

Elsewhere in North America, Canada has undertaken a six year program to make itself "the most connected country in the world." A major part of Canada's initiative is the Community Access Programme (CAP) which set a deadline of March 31, 2001 to establish 10,000 computer and Internet sites across the nation. Initially a rural-oriented effort involving about 5,000 sites, political leaders stunned CAP personnel by insisting on a comparable program for urban areas.

In Europe, the Hungarian government supports a robust eight-year old telecenter program (triggered by USAID) that has resulted in more than 150 telecottages; and, in an optimal scenario, within 5 years about 500 to 800 telecottages will "blanket" the country. (Bihari and Jókay, 1999:13)

The Costa Rican Government has recently decided that it wants all its people to have access to information and communication technologies (ICT) - so it is embarking on a project to have telecenters in each of its 89 *municipios*.

From Australia to South Africa, governments are taking steps to bring people within reach of computers, the Internet and other 21st century communication technologies. "The important point about the digital divide," says Mark Cooper in a recent report, " is not simply that some people have the technology and others do not, but that not having it puts people at a disadvantage and cuts them off from participation in important economic, social, cultural and political activities." (Cooper, 2000)

2. Ten themes for telecenter sustainability

We are less than ten years into the real telecenter movement although there were many prominent ancestors, including, for example, the telecottages in Scandinavia in the mid-1980s and the Open Learning Centres in Queensland (Australia) in the late 1980s. But it was the Internet along with significant advances in computer technology and comparatively lower ICT prices in the mid-1990s that launched today's powerful movement. It propelled the big international players mentioned earlier onto the telecenter frontier.

Basically, telecenters are shared public facilities that provide telecommunication services to persons who, for various reasons, do not have them available individually. From place to place, telecenters have significantly different features and researchers have proposed telecenter typologies and classifications based on multiple variables. But beyond the precariousness of the concept, all telecenters, be they on a village in Sub Saharan Africa or South India, or in a remote town in Mexico, Canada or Australia, have an unmistakable characteristic in common: they offer *shared* access to information and communication technologies. (Roman and Colle, 2001). They are public places where people can use computers, the Internet, and other media; get training; and often obtain a variety of other communication-related services. They differ from the cybercafe-type places which tend to be narrowly focused on Internet and computer access.

So here we are into the 21st century with telecenters springing up all around us, and what can we say about our experience to date? What can we say to those start-up initiatives in Costa Rica or Eastern Europe, India or the Philippines besides confirming that some telecenters are thriving and some have already failed? Our research team has visited telecenter programs in Canada, the U.S., Hungary, South Africa, Australia and India, and we have studied reports from Tunisia, Peru, and other countries on the way to preparing a management manual for telecenter personnel. There are many differences among these operations, but we perceive some themes that may be useful guides in telecenter development.

(1) *The power of a national commitment by policy-makers who recognize the value of connecting the people of the country through the modern tools of the Information Society, and follow that with funding and organizational support for multi-year programs.*

The Okinawa Charter is an example of a international political commitment, but we have yet to see if there will be significant concrete support for its declarations. The Canadian Government went beyond the rhetoric of an Information Society and committed people and funding to making the Internet affordable in rural and urban communities across the nation through its 10,000 location Community Access Program (CAP). With a six year commitment, it made start-up money available and created an infrastructure to help local organizations make it work. While the resources offered are not enough for a complete comprehensive multi-purpose telecenters, the *imprimatur* of the national government combined with some serious money significantly motivated a nationwide community-based effort that attracted provincial, regional and local participation.

Similarly, in Australia the Federal Government's policy to create the "Networking the Nation" fund has been instrumental, among other various activities, in Tasmania's development of 59 Open Access Centres, and a program in New South Wales to set up 55 multi-purpose "Technology Centres". (Short and Latchem, 2000) In South Africa, the 1996 Telecommunications Act created the Universal Service Agency which has been the key actor in establishing telecenters in under-served and rural areas of the country. (Fuchs, 1998)

Besides the direct funding available and the administrative push, a national policy can also be instrumental in providing a favorable regulatory and tariff climate. And to support its policy goal of becoming an Information Society superpower, the Indian government doubled the number of persons it would graduate from its technology training institutes.

Thus a national policy can give visibility and help mobilize resources for a building the infrastructure and programs that promote access and use of information and communication technologies.

(2) *The importance of partnerships in translating national policy into action through governmental and non-governmental bodies at the regional and local levels.*

National policy and national government funding do not necessarily translate into centralized planning and operations. Hungary has demonstrated that a former socialist country steeped in centralized planning could develop a "telecottage" system built on local non-governmental organizations (NGO) with community ownership and management. It is called a "civic initiative" with its emphasis on local NGOs applying for government telecottage grants and showing that they have the support of local governments or private organizations. Industry Canada built into the CAP application process an explicit recommendation that community organizations proposing access sites seek out partners who can share technical, financial and personnel resources. In some provinces, a partnership with a library opened the way for the CAP site to obtain free computers from a Gates Foundation grant.

In the health field, various international organizations are setting up ICT systems that could be partnered with community multi-purpose telecenters. For example, in 2000, the organization Health Information for Development (HID) in the United Kingdom laid out a plan to set up - particularly in developing nations - health information resource centres called Information Waystations. These are backed by information-collecting-and-processing "hubs" called Staging Posts. The intent is to funnel appropriate health information from nations in the North and the South to individuals and local health workers in developing nations using locally relevant terms. About the same time, the World Health Organization presented a seven year plan to establish the Health InterNetwork Project. It is an initiative to facilitate the flow of health information worldwide using Internet technologies. Among its provisions are reliable and relevant local and international public health content and 10,000 to 14,000 new public health information access points, linked with an electronic/Internet-based Health InterNetwork portal. With the significant interest in the health field on producing, packaging and distributing digital health information, there seems ample opportunity for partnerships to emerge between local health organizations and telecenter people.

(3) *The value of having local "champions" (innovators) who can mobilize others (early adopters, opinion leaders) to accept the vision of an ICT telecenter program.*

The obscurity and abstractness of the "Information Society" requires the missionary zeal of individuals who can translate and demonstrate the relevance and application of these kinds of concepts to the realities of the community. And for the innovator to be from the community itself increases the credibility of the telecenter initiative. The professional literature on the diffusion of innovations points out the importance of the innovator. "The innovator," says Professor Everett Rogers, "plays an important role in the diffusion process: That of launching the new idea in the system by importing the innovation from outside the system's boundaries" and igniting "early adopters." (Rogers, 1995)

(4) *The significant value of community volunteers in operating telecenters*

In documents describing CAP, Industry Canada says: "Volunteers, volunteers, volunteers....a CAP site requires the support of many dedicated and talented volunteers." In most communities, volunteers offer a variety of benefits to the programs. They contribute to the day-in, day-out supervision of the facilities - a potential personnel expense that many communities could not afford. But the volunteer has deeper significance: the variety of volunteers in a system provides telecenter clientele with models with whom they can identify and feel comfortable. In telecenters throughout the world, one can find high school and college students, retired business people, active school teachers and others providing one-on-one and group training and assistance. Volunteers can also contribute to enlightened decision-making in the telecenter because they reflect a variety of community constituencies.

The challenge for telecenters is to move from largely spontaneous use and management of volunteers to developing an explicit strategic plan for recruiting, training, retaining and rewarding volunteers. Trish Barron in Western Australia's Telecentre Support Unit summarizes the volunteer issue in three words: "Gain, Train, Retain." With 2001 being the International Year of Volunteering, perhaps it is time to concentrate on this issue.

(5) *The advantages of clusters or networks of telecenters working together in a region to develop and share a variety of resources.*

The Western Australia Telecentre Network Support Unit illustrates well what can be done when telecenters are combined in some way so that they share a support system. The Support Unit lobbies, seeks funding, develops initiatives, and carries out a variety of other management functions for the 76 members of the Network. In Canada, the CAP administrative system includes provision for regional coordinators who supervise sites in their geographic areas. In some cases, the coordinators have successfully aggregated CAP sites for carrying out joint projects. These projects may involve training, sharing of resources, problem solving, and other activities. In some cases, joint projects to develop locally-relevant information and data bases (for example, French language ones in heavily English language Canada) would help sites increase their relevance to their communities.

In Canada and Hungary, telecenter sites themselves and joined together to initiate collaborative projects, achieving some economy-of-scale advantages. These efforts have sometimes resulted in a formal membership body. Architects of telecenter systems should build such support components into their systems, and devise a method for funding them, such as member fees. In 2001, in a project supported by PanAsia, we will join the Tamil Nadu (India) University of Veterinary and Animal Sciences to set up a cluster of telecenters and specifically test some aspects of support units, including the viability of using universities in this capacity.

(6) *The importance of popularizing the belief that information and ICTs can be a valuable resource for individuals, families, organizations and communities.*

Computer giant Bill Gates startled many in the information technology field when he declared in the *Guardian* newspaper that "the world's poorest two billion people desperately need healthcare, not laptops." (Helmore and McKie, 2000) And one hears a message around the world: it's no "field of dreams" - referring to the appearance of telecenters in a community and the absence of many users. Both of these situations reflect that many people may see little significant connection between information technology and direct benefits to a family's or a community's needs. However, there are other perspectives. There's a story of a woman in India who complained about her vision: she said it was like having a saree over her eye. Through information she obtained at a telecenter about a traveling health team visiting her area, she had a simple operation and removed the "saree" (cataracts). And there is the farmer in northern Shaanxi Province in China who traveled 500 kilometers to an agricultural information center where he found information "on-line" that helped him market his apples and find an export outlet for his pumpkins (to Japan).

A recent report in *The New York Times* tells of a district in India's state of Madhya Pradesh where villages bought a computer system and the state picked a young person with at least a 10th grade education to print out and sell information from the state's computer network. The story tells us:

> For 25 to 35 cents, villagers buy printouts of documents that they might have spent days trying to get from local bureaucrats: land records, caste certificates and proof of income, among others.
>
> For another 25 cents, any citizen can send a complaint to the state by e-mail - my pension didn't arrive, my child's teacher didn't show up, my village hand pump doesn't work - and the state guarantees a reply within a week. And for 10 cents, a farmer can get a printout listing the prices of any agricultural commodity sold at surrounding markets. (Dugger, 2000:10)

In the village of Bagdi, the farmers collect the day's price lists for wheat, garlic, and other crops and use these to negotiate with middleman. "If the price he offers suits me, I'll sell to him," says one farmer. Otherwise I'll take it to market myself."

Government or private sector initiatives targeting popular participation in the Information Society should consider planning vigorous campaigns to illustrate the benefits of information as an important resource for daily living - assuming they, themselves, are reasonably convinced. (Johan Ernberg, formerly with the ITU, argues for the relevance of ICT to a nation's health and welfare on a more macro level in Ernberg, 1998a).

(7) *The role of research in creating a viable telecenter enterprise.*

We see relatively little time or resources devoted to research in telecenter initiatives. The ITU's multi-purpose telecenter initiative begun in the late 1990s created multi-purpose telecenters and called them pilot projects, making them somewhat research-related. And Johan Ernberg has raised a list of questions that might be answered by the pilot projects. These range from how do we get international and national organizations to cooperate - to who pays for new telecenters and what is their impact. (Ernberg, 1998b)

Some of these are quite large and complicated research questions, perhaps appropriate for university people. But research needs to be done at the individual telecenter level. Telecenter personnel should have simple, reliable tools to use in on-going operations - tools that (1) help them discover and continuously monitor the needs of the community, (2) get a reliable picture of the demographics of the area, (3) systematically monitor on-going operations, and (4) help check systematically on outcomes and consequences. This goes beyond counting the number of users, although this is an important statistic. The IDRC's Ann Whyte has contributed to this process with her manual entitled *Assessing Community Telecentres, Guidelines for Researchers* (2000) but it will take considerable dedication for telecenter personnel to digest and use it unless there are significant incentives to do so.

(8) *Telecenters need for long term sustainability and business plans that fit the culture of the community.*

Most telecenters operate in a not-for-profit mode, but that does not necessarily mean not-for-income. Typically donor agencies reduce or discontinue financial support for telecenters after an initial incubation period. Few of the telecenters across Australia have guaranteed on-going funding. Western Australia is the exception where the state government has incorporated telecenter support into at least a four year commitment - through 2003. (Short and Latchem, 2000)

Other programs in Australia and the Hungarian system have been innovative in developing income-come producing activities to support telecenter operations. Among the telecottages in Hungary, there are more than 50 different services offered to the community. These range from blood-pressure measurement (provided by 25% of the telecottages in 1999) to computer games (offered by 94%) and social services assistance (44%). In Hungary, a major source of support for telecottages are the contracts that they obtain from government agencies, thus becoming (for a fee) extensions for government services. (Bihari and Jókay, 1999) The Queensland Open Learning Network's Learning Centres offers training courses which are paid for by trainees' employers or by the individuals themselves. Businesses and industry groups pay for use of the teleconferencing facilities, and institutions in the community pay membership fees to the Centres.

In contrast, elsewhere there is the telecenter getting three years of funding but its leadership makes no effort toward independent income generation. The center is expected to expire after the government funding ends.

In our research on telecenter training (in which we surveyed a panel of experts from around the world), one of the most frequently suggested areas of training for telecenter managers was in the area of business planning aimed at making telecenters self-sufficient and sustainable. (Roman, 2000)

In approaching the issue of sustainability, telecenters face the question of how they can generate income yet serve those in the community who cannot afford to pay for "public goods" kinds of services. (like access to health information). Some centres use the income from user fees and other income services to make public goods affordable or free. (We have used the name Communication Shop to denote the commercial possibilities of community-based communication centres. See Colle, 2000.)

(9) *Focusing on information services rather than on computers and the Internet alone to build a local institution more fully woven into the fabric of the community, with a larger base for generating income.*

This theme is closely related to the previous one. One of the lessons learned during the early stages of the Western Australia Telecentre Network was "that to look upon these centres as simply educational providers or access centres was a flawed model." (Short and Latchem, 2000) One visiting the rural telecenter in Gingin (Western Australia) can see a variety of services, including a bank, which was added because the regular bank in the community decided to close its operations. Similarly, others - like those in Canada's CAP, the Community Learning Centres (CLC) supported by the U. S. Agency for International Development, and the Hungarian telecottages - take the position that telecenters need to be significantly more than computers and the Internet to meet fully the potential of these institutions. "A robust center," say some, "will provide a range of traditional, non-electronic resources as well." (Dorsey, Hess and Fuchs, 2000) Tasmania's Open Access Centres offer services to local businesses, act as gateways to Federal and State Government online services, and provide lifelong learning and training opportunities. (Short and Latchem, 2000)

Mature telecenters must be in the information and communication business (or the community development business), not only the computer and Internet business. They can systematically assess community information needs and the communication needs of other local organizations, and be creative and entrepreneurial in dealing with these needs. It is this broader approach to the Information Society that helps centres become more firmly woven into the fabric of the community and puts them on the road to self-sufficiency.

(10) *Participation as an important goal that requires a strategic approach.*

With widespread interest in the digital divide issue, broad-based community participation may become part of the telecenters' mandate. This may present a challenge in reaching out to ethnic minorities, women, children and the elderly who are often on the minus side of the divide. Sometimes the "learning" label on a centre, or the technology, or its location in a library or school intimidates those who might benefit from the services. So physical connectivity may not equal sociological access or effective participation

It is generally accepted that conscientious attention to participation can yield benefits in such activities as assessment of information needs, planning, and operations. The value of participation is woven throughout the Industry Canada philosophy and procedures for CAP. This is illustrated, for example, in its emphasis on volunteers, and the requirements that applicants have local councils and evidence of community support. It is also illustrated by comments by CAP site people who say that they know participation is important but they haven't worked on it yet.

Part of the problem results from the ambiguity of the participation *concept,* and the need to translate it into concrete action terms. It is not something that managers do spontaneously or naturally. Nor is participation always culturally supported. Telecenter management should develop an explicit participation strategy in the planning stages. The strategy should address at least the following questions:

Why is participation important to this project? Among the answers might be: because it conveys a sense of community ownership; it provides indigenous wisdom; it helps reflect community values and needs; it provides important resources, such as volunteers or technical expertise, at a favorable cost.

Who should participate? It is not enough to say "the community." Who should receive attention because of the possibility they will be marginalized - like women, poor people, minorities, the elderly?

How might people participate? The easy answer is to say that all can participate through use of the ICT facilities. But there are other potential dimensions of community participation in a telecenter: volunteers who oversee daily operations, tutors who give lessons, advisory groups for different aspects of the operations, people who provide links to other community organizations, and people who manage particular data bases and add value to information resources.

How much participation should be sought? Is maximum participation the goal, or should there be a target called *optimal* participation? It is not hard to imagine that there can be situations where there is too much participation.

When should participation take place? It probably should begin no later than the time in the planning when participation itself is being considered. Being specific about the timing avoids the "we haven't got to that yet" explanation.

What incentives can be offered? (Or, how do you get people to participate?) Money and public recognition are important, but so too are special privileges regarding use of telecenter facilities or discounts from shops in the community (which is a way that merchants can participate).

3. The role of training

We end with what could be listed as number 11 on the above list, but, in fact, it runs through several of those items: it is training. Telecenters need a variety of skills to insure that they contribute successfully to community informatics. These include: some basic computer skills, practical research skills, information production and information management, training know-how, community relations, human resources management and, of course, business planning. Not all of these skills need to reside in one person, but they are essential to have among the management or leadership team. (Roman, 2000). Experience around the world suggests that training or recruiting to bring these skills into a telecenter is a key to dealing effectively with the emerging themes in this paper. Thus, a telecenter initiative is likely to be successful to the extent that it incorporates training in its start-up and continuing operations.

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Back to top of page **Back to the sessions page**

Abstract

The initiation, diffusion and adoption of the telecenter idea has been an enormously eclectic process, largely devoid of systematic research and planning. The approach has generally been one of pilot projects - trying out models to see what works to achieve a diversity of objectives. In some cases the approach has been simply entrepreneurial, with enterprising business people exploring new opportunities for profit-making.

A range of important issues are linked to the operation and success of telecenters. These include: sustainability, community relevance, government policy, information and community technology, community partnerships and participation, telecenter objectives, and business planning. Often mentioned but largely undeveloped is the training associated with telecenter management, an issue that relates to all of the issues mentioned.

While each of the issues deserves systematic analysis, this presentation concentrates on sustainability and training. Based on data collected from Australia and South Africa to Hungary and Canada - and from various project documents - we describe some of the strategies being used to sustain telecenters

Go to proceeding page　Back to the sessions page

Business & Applications

Wednesday, 17 January 2001
1030–1200

W.2.2 EDU-COMMERCE–Where Education Meets Commerce

Location: South Pacific II

Chair: SALLY M. JOHNSTONE, Director, Western Cooperative for Educational Telecommunications, *USA*

PowerPoint Presentation

The education landscape is being radically transformed not just by new technologies, but by dot.com approaches to doing business in what is emerging as a lively education marketplace. New companies strive to meet the universal need for lifelong learning in the information age, virtual universities in a range of configurations are succeeding and failing in Internet time, new startups are disintermediating student support services out from under traditional universities, and traditional universities are spinning off for-profit subsidiaries to capitalize on their names and intellectual resources. This panel will bring together experts in this changing marketplace to share their observations and speculations with attendees in a lively and interactive session.

Speakers:

The Changing University Environment - "Toward Market Sensibility"

GORDAN FREEDMAN, Executive Vice President, Prometheus.com, *USA*

EDU-Commerce - Where Education Meets Commerce

TERRY HILSBERG, Chief Executive Officer, NextEd Ltd, *Hong Kong SAR China*

EDU-Commerce - Where Education Meets Commerce

PHILLIP CLARK, General Manager, Strategy and Global Solutions, SCT, Inc., *USA*

Sally M. Johnstone

Director
WCET
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Boulder, CO 80303
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Dr. Sally M. Johnstone is the founding director of the Western Cooperative for Educational Telecommunications (WCET) at the Western Interstate Commission for Higher Education (WICHE). In that role she is a resource for state governing boards, legislators, governors, as well as college and university administrators on higher education technology issues.

The WCET is a membership organization with staff located in Boulder, Colorado. Its 240 members are located in 44 U.S. states and five countries. The WCET staff develop research projects focusing on the integration of technology into the teaching and learning processes, consult with higher education institutions, hold professional development institutes for practitioners, and generally support their members in the planning for and implementation of distance learning.

Johnstone serves on the Board of the American Association of Higher Education (AAHE), the U. S. Open University's Board of Governors, and the Advisory Panel for the Consortium for the Advancement of Private Higher Education. She earned her Ph. D. in experimental psychology from the University of North Carolina at Chapel Hill.

Back to proceeding page   Back to the sessions page

EDU-COMMERCE -
Where Education meets Commerce
W.2.2

Pacific Telecommunications Council
17 January 2001

Sally M. Johnstone

Slide 1 of 14

EDU-COMMERCE

Gordon Freedman

Prometheus, Inc, U.S.A.

Terry Hilsberg

NextEd, Ltd, Hong Kong

Phillip Clark

SCT, Inc., U.S.A.

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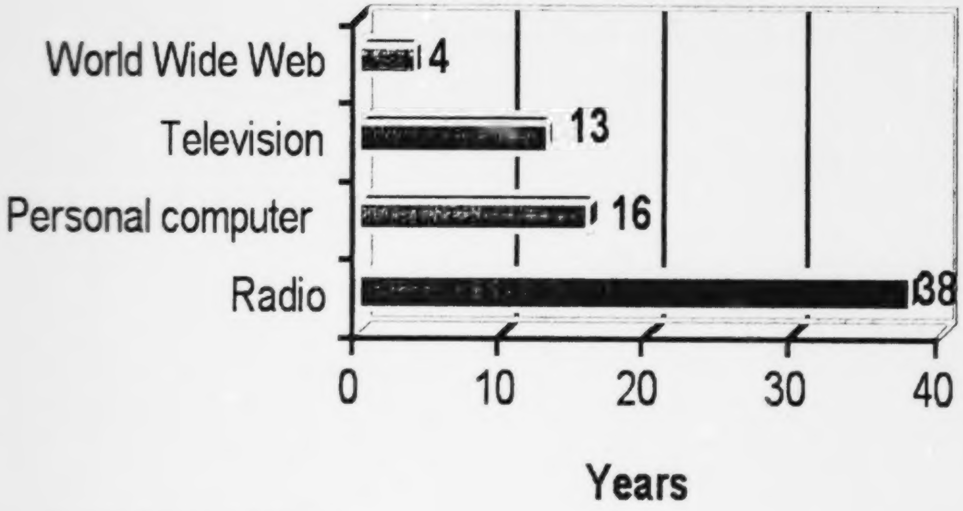
Years to 50 million users



Source: Economist 1998

Slide 3 of 14

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Net or 'N' Generation:

They are 12 - 17 years old.
In the U.S., about 65%
of them subscribe to
online services or have
access to online services.

Distance Learning Trends in the U.S.

U.S. Dept of Ed 1998 survey released Dec.'99

- ~ 78% public 4-year & 62% public 2-year offer DL
- ~ 87% of all institutions over 10,000 enrollments
- ~ From 1995 - 98
  - 33% increase in institutions offering DL
  - Number of DL courses & enrollments doubled
  - Internet courses increased by 32%
- ~ Internet and video most popular technologies

Future of e-learning

-WR Hambrecht & Co (online investment bank)

- U.S. education & training market in all segments in 2000
  - ~ $772 billion
  - 9% U.S. GNP ... 2nd only to healthcare
- E-learning market expected to be $5.5 B by end of 2002

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Speed of tech adoption challenging HE's traditional autonomy

- Governmental pressure to leverage investments in technology
  - U.S. states forming collaborative virtual universities
- Private institutions cooperating
- *Quality in Online Education: Results from a Revolution...*Witherspoon & Johnstone

Speed of tech adoption challenging HE's traditional autonomy

Institutions can not afford to keep IT support personnel

New support systems have to be developed ...

library access, advising students, help desks, etc

www.wiche.edu/telecom

Institutions buying services from vendors...

content, help-desk, marketing, registration, testing

New businesses plugging into the gaps in colleges' and universities' capabilities.

EduCommerce …

EduCommerce Categories

Content providers
Technology vendors
Service providers

Content Providers

Content providers author and publish intellectual property. Delivery methods and media vary.

- **Pearson Publishing**
- **Archepelago**
- **Discovery Channel**

Technology Vendors

Technology vendors provide creation and capture tools, enterprise systems, and learning-specific hardware.

- **Sun**
- **Cisco**
- **Compac**

Service Providers

Service providers offer a variety of learning-related services:

- integrated service provider - NextEd
- learning management systems - Prometheus
- other professional services - **SCT**

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Western Cooperative for Educational Telecommunications

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EDU-COMMERCE -
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W.2.2

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EDU-COMMERCE

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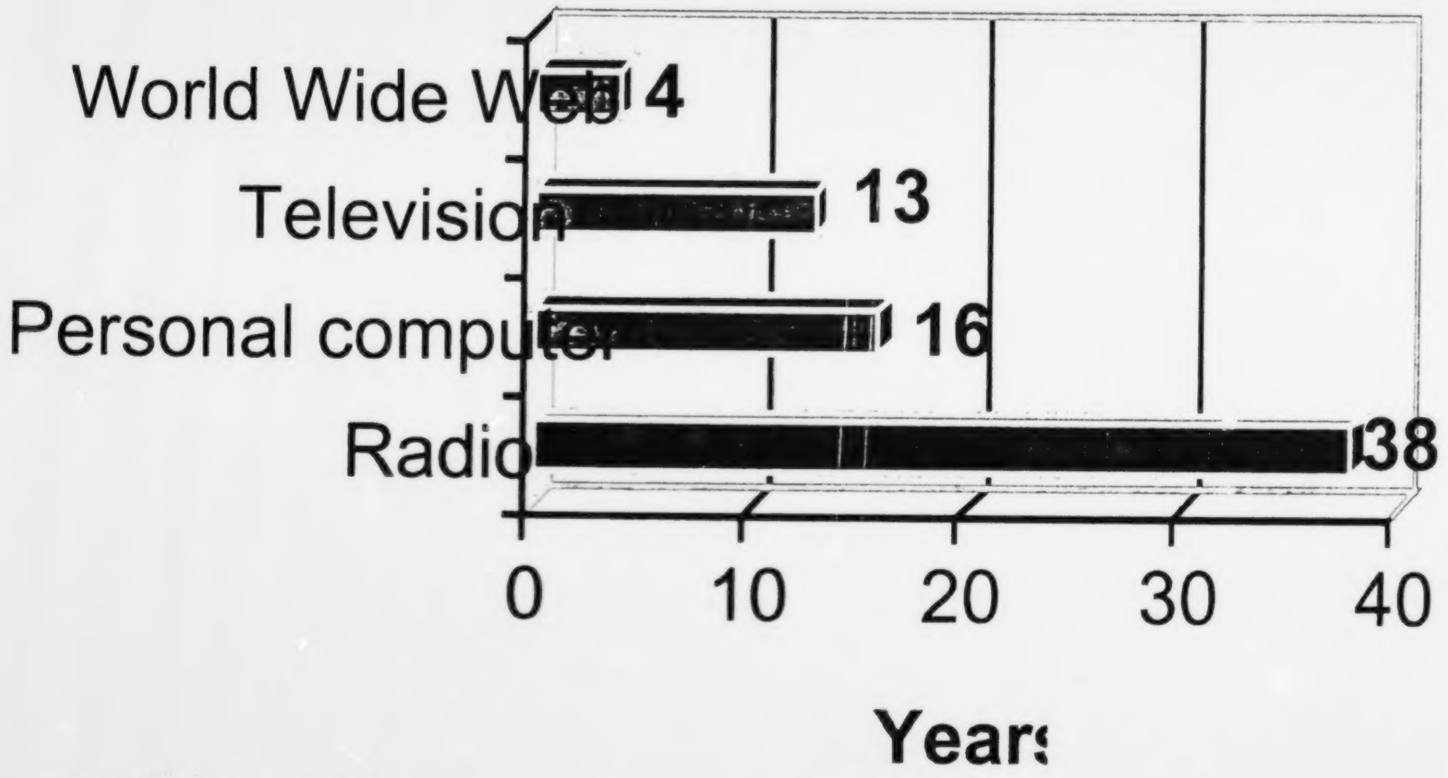
Years to 50 million



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Microsoft PowerPoint Presentation

Click here to start

Table of Contents

PPT Slide
PPT Slide
PPT Slide
PPT Slide
PPT Slide
PPT Slide
PPT Slide
PPT Slide
PPT Slide
PPT Slide
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Author: Gordan Freedman

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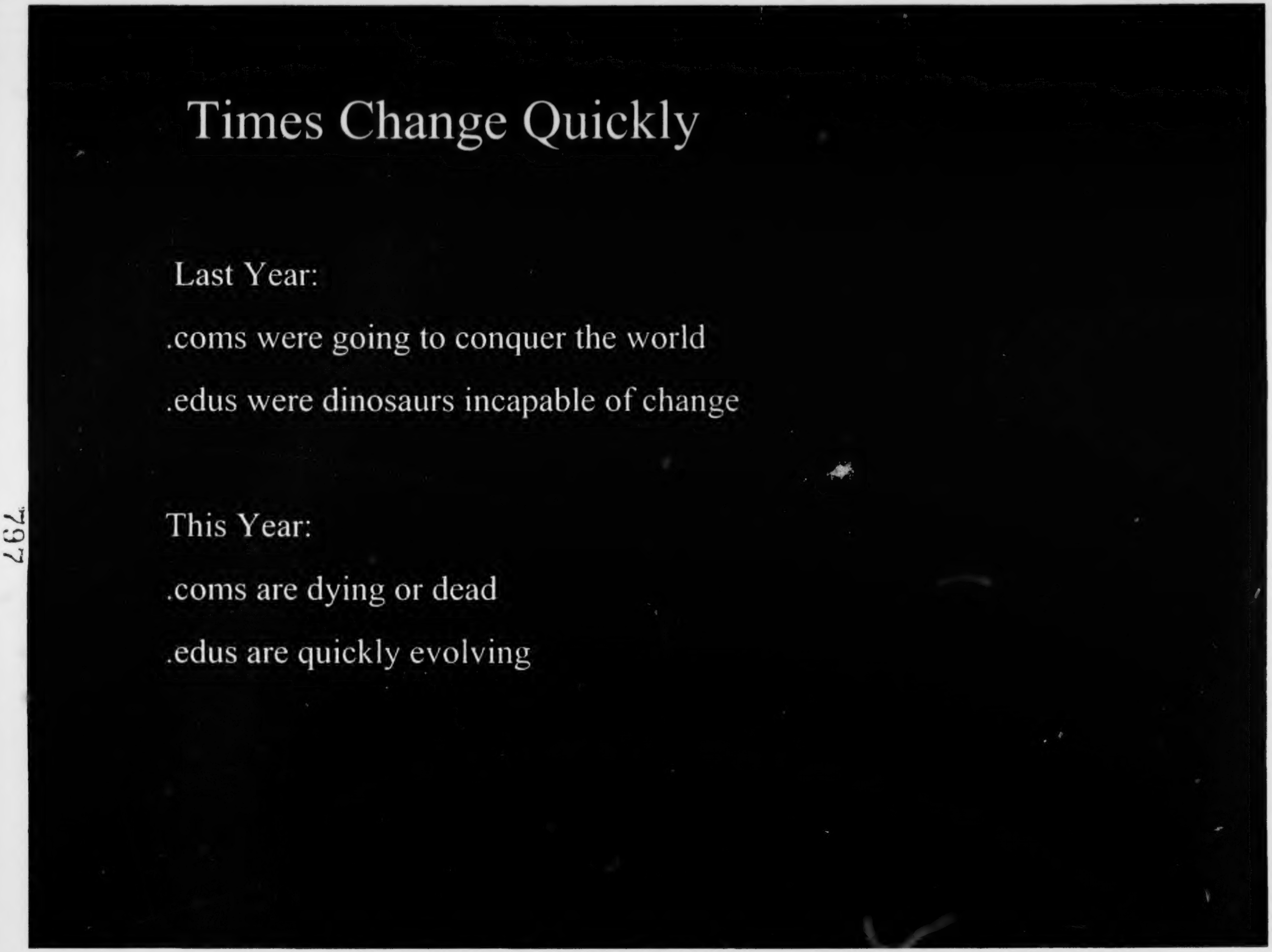
Gordon Freedman

Executive Vice President, Prometheus

A Learning Infrastructure Company from George Washington University

THE CHANGING UNIVERSITY ENVIRONMENT

“TOWARD MARKET SENSIBILITY”



Times Change Quickly

Last Year:

.coms were going to conquer the world

.edus were dinosaurs incapable of change

This Year:

.coms are dying or dead

.edus are quickly evolving

Operating Environments

Universities:

Money in the Bank (endowments)
Cash Flow (students)
Technical Infrastructure (sunk cost)
Content Expertise (faculty)
Commercial Business Acumen

Start-Ups:

Money in the Bank (high cost money)
Cash Flow (negative)
Technical Infrastructure (expensive)
Content Expertise (must purchase)

Commercial Business Acumen

The Three Trends

Centralization: Decisions Move to Middle

Integration: Services are Bundled

Externalization: Location is Not as Important

Bottomline: Concentrate on Mission

University E-Learning: A Movable Feast

- The University Environment is Evolving
- Universities must Transform Themselves
- Universities will Pay Large Sums for Solutions
- Universities will Seek Alternate Revenue Streams

The University Environment is Evolving

- Decision Making Is Shifting
- Infrastructures are Central Issues
- Student Base is e-Literate
- Faculty Are Accepting e-enhancements

Universities Must Transform Themselves

- Population Bubble Requires Cheaper Delivery
- Tuition Alone Cannot Support Universities
- University Have to Play Expanded Roles
- Single Changes Lead to Systemic Changes

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Universities will Pay Large Sums for New Solutions

- To Be Competitive & Efficient
- To Be Mission Critical
- Governance will Exert Influence
- Vendors are Highly Organized

Universities will Seek Alternate Revenue Streams

- Universities will Realize their Power Base
- Universities will Understand the Need to Partner
- Universities will Learn to Conduct Business
- University VPs of Finance will Gain More Power

Opportunity = Understanding

- Remove Micro Cultural Biases
- Understand Playing Field from Each Perspective
    - Student, Faculty, Vendor, Market, Admin
- Define, Link, and Work In Market Segments
- Make Objectives the Goal, Not the Structure
- Take Risks Based on Analysis, Not Hunches or Feel
- Find Defendable Niches
- Be Open to Partnerships, Alliances, and Change
- Build Only What You Need, Buy the Rest Wisely

Thank You

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gordon@prometheus.com

Gordon Freedman serves as the Executive Vice President of Prometheus.com, a courseware development company associated with George Washington University.

Gordon Freedman is an expert and advocate of universities and other non-profits working in the for-profit sector. Freedman develops and assists on strategies that allow universities and museums to meet the challenge of using technology to create and distribute education at all levels.

"Education and learning are cornerstones of society. As we advanced into a fully digital and electronically distributed world, we need to take care to insure that the very best of teaching and learning finds its way into this new paradigm."

Back to proceeding page **Back to the sessions page**

Presentation PTC

Click here to start

Table of Contents

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Download presentation source

- Presentation PTC
- Who are NextEd ?
- What do we do?
- Global University Alliance
- My Mission
- Themes
- A. Who is gaining market share in Asia?
- Local entrepreneurs
- Course price vs. volume- Asia
- The Growth of Giants
- B. The University as a Global Extranet
- PPT Slide
- C. Disruptive technology = value chain contestability
- Vertical Disaggregation
- Shifts in value chain ownership

D. Market Still Crossing the Chasm

What works in H.E Electronic Delivery

PPT Slide

D. New forces in Asian HE industry structure ?

The current model is broken

1. The Product is changing

2. Production must be digitized

3. Pricing becomes flexible

4. Changes in distribution structures

PPT Slide

PPT Slide

PPT Slide

Electronic distribution partnerships

5. Primacy of Customer Segment Management

6. What do you want to be?

Conclusion

Presentation
PTC

Jan 2001

Who are NextEd ?

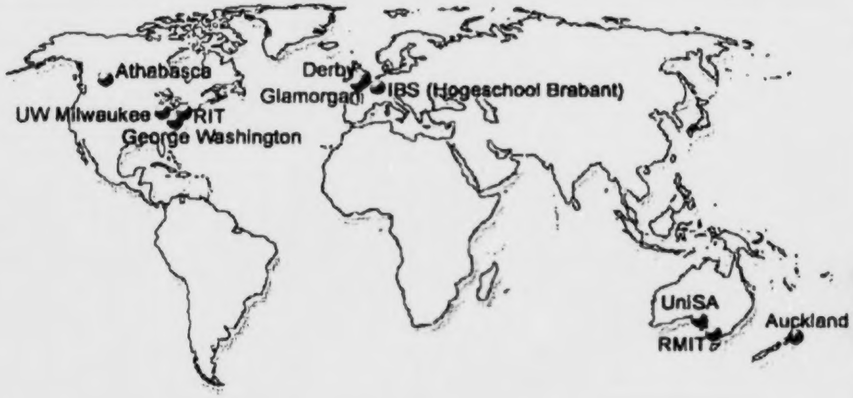
- Education services platform partner
- Hong Kong HQ
- Ownership – Majority USA, with HK, Australia
  - Fidelity
  - GE Equity
  - JH Whitney
  - Kuok Group
- Dedicated higher education delivery environment spanning 13 countries
  - >200 awards, 1400 courses under contract

What do we do?

- Course development
- Delivery Infrastructure
- Academic support
- Marketing and sales

Reward: 5-80% of student fee

Global University Alliance


Athabasca
Derby
Glamorgan
IBS (Hogeschool Brabant)
UW Milwaukee
RIT
George Washington
UniSA
RMIT
Auckland

UW MILWAUKEE

International Business School

AUT AUCKLAND UNIVERSITY OF TECHNOLOGY
TE WANANGA ARONUI O TAMAKI MAKAU RAU

The George Washington University
WASHINGTON, D.C.

R·I·T Rochester Institute of Technology

RMIT UNIVERSITY

UNIVERSITY OF SOUTH AUSTRALIA

Athabasca University

University of Glamorgan

UNIVERSITY of DERBY

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My Mission

Provide an international (Asian) commercial perspective on impact of new technologies upon higher education industry structure

Themes

- Who is gaining market share in Asia?
- The University as a global extranet
- Disruptive technology = value chain contestability
- The market – still crossing the chasm
- What works today in Asia - Clicks and Mortar

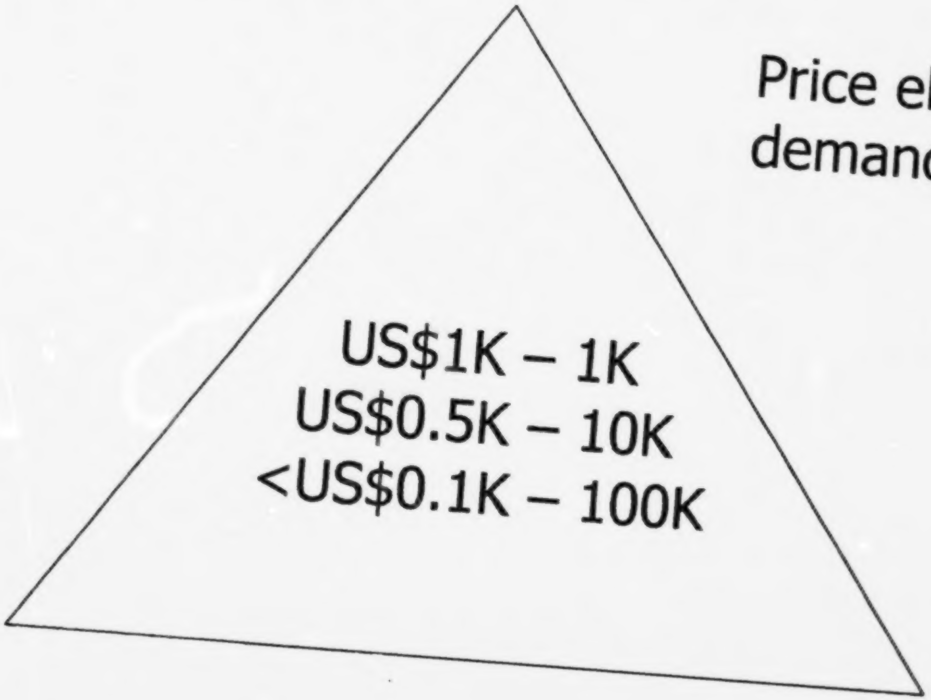
A. Who is gaining market share in Asia?

Local entrepreneurs

- Asian H.E - Last 10yrs CAGR 10-25%p.a
- Winners of market share
  - Asian, mainly Chinese, entrepreneurs
  - UK and Australian universities
- Growing but losing market share
  - Domestic government funded H.E sector
  - Generally not scaleable
- USA uninvolved
  - USA H.E sector – no compelling reason for involvement

Course price vs. volume- Asia

Price elasticity of
demand is high



US$1K – 1K
US$0.5K – 10K
<US$0.1K – 100K

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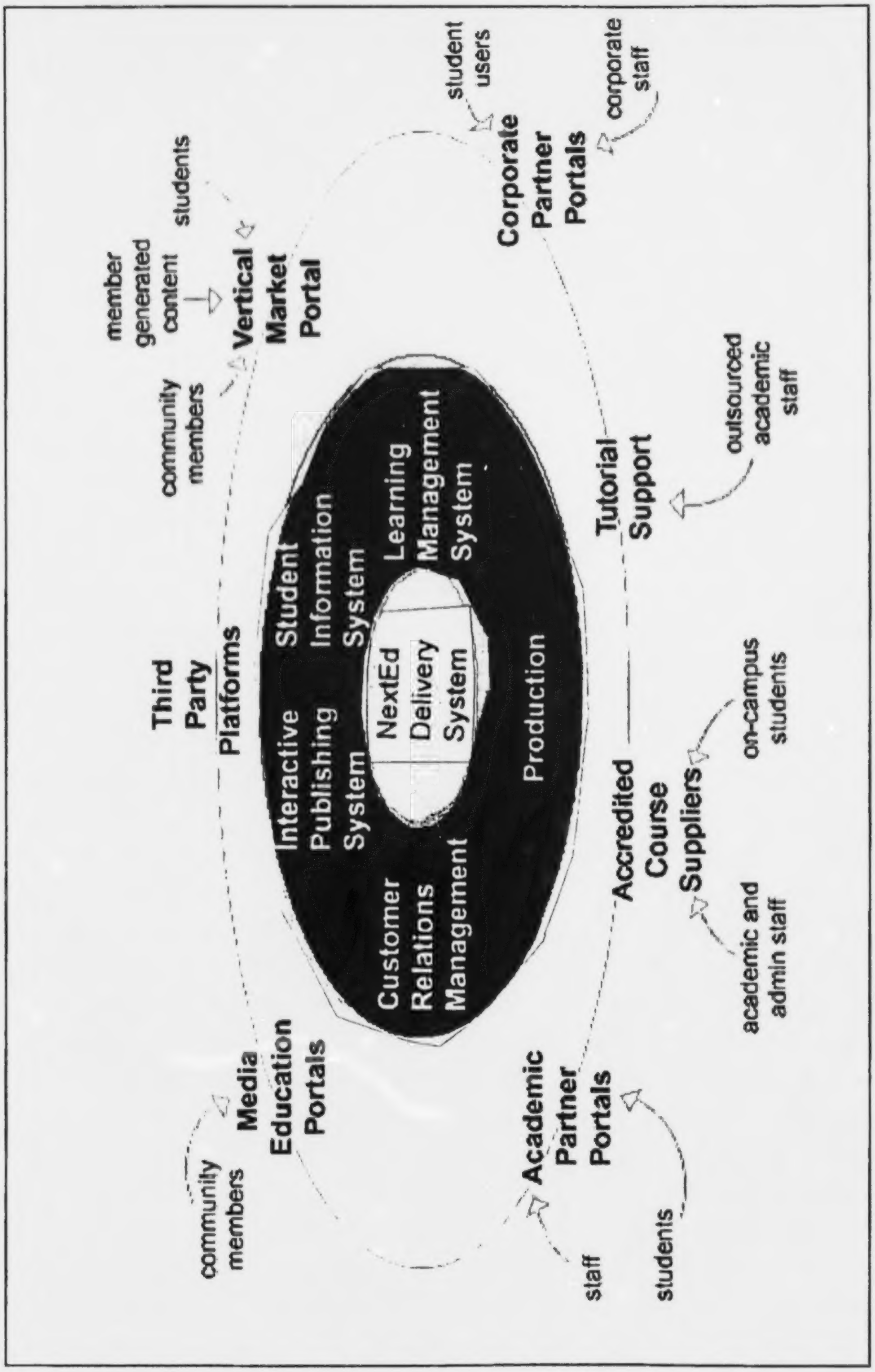
The Growth of Giants

- Real price of H.E in Asia increasing at 2-5% p.a
  - Suggests the "Honda" strategy
- Some giants emerging concentrating upon:
  - Ownership of Student – via distribution
  - Infrastructure
  - Scaleable production
  - Lesser extent, content
- Example NIIT – US$250M p.a/US$70M p.a profit

B. The University as a Global Extranet


NextEd Delivery System
Interactive Publishing System
Student Information System
Learning Management System
Production
Customer Relations Management
Third Party Platforms
Vertical Market Portal
member generated content
students
community members
Corporate Partner Portals
student users
corporate staff
Tutorial Support
outsourced academic staff
Accredited Course Suppliers
on-campus students
academic and admin staff
Academic Partner Portals
staff
students
Media Education Portals
community members

C. Disruptive technology = value chain contestability

Vertical Disaggregation

Layer	Examples of Players
Student eyeball and demand aggregators	Student Advantage.com; Zapme.com; collegestudent.com; collegeclub.com; grade-it.com; collegepro.net; versity.com; studentu.com; monster.com; myinternet.com
Course aggregators Portals	Headlight.com; Click2 learn.com; Learn.com; University Access; smartplanet.com; newpromise.com; free-ed.net; wgu.com
Front end service providers	Zenzibar.com, Campus Pipeline.com; embark.com; fastweb.com; eStudent.com
Platform service providers	eCollege; Embanet; Convene; Eduprise; NextEd; UOL; online.edu
T and L Software providers	ULT, Blackboard; Prometheus; Lotus; WBT
Student Learning services	Smarthinking.com; tutornet.com
Course providers	Onlinelearning.net; Pensare; Morningside ventures; Skillsoft.com, Digitalthink; ZDU; prosofttraining.com
Course hosting platforms	Click2learn.com, Blackboard.com
Back end Software providers	SCT, Datatel, Peoplesoft

Shifts in value chain ownership

Disaggregation leads to contestability of the value chain

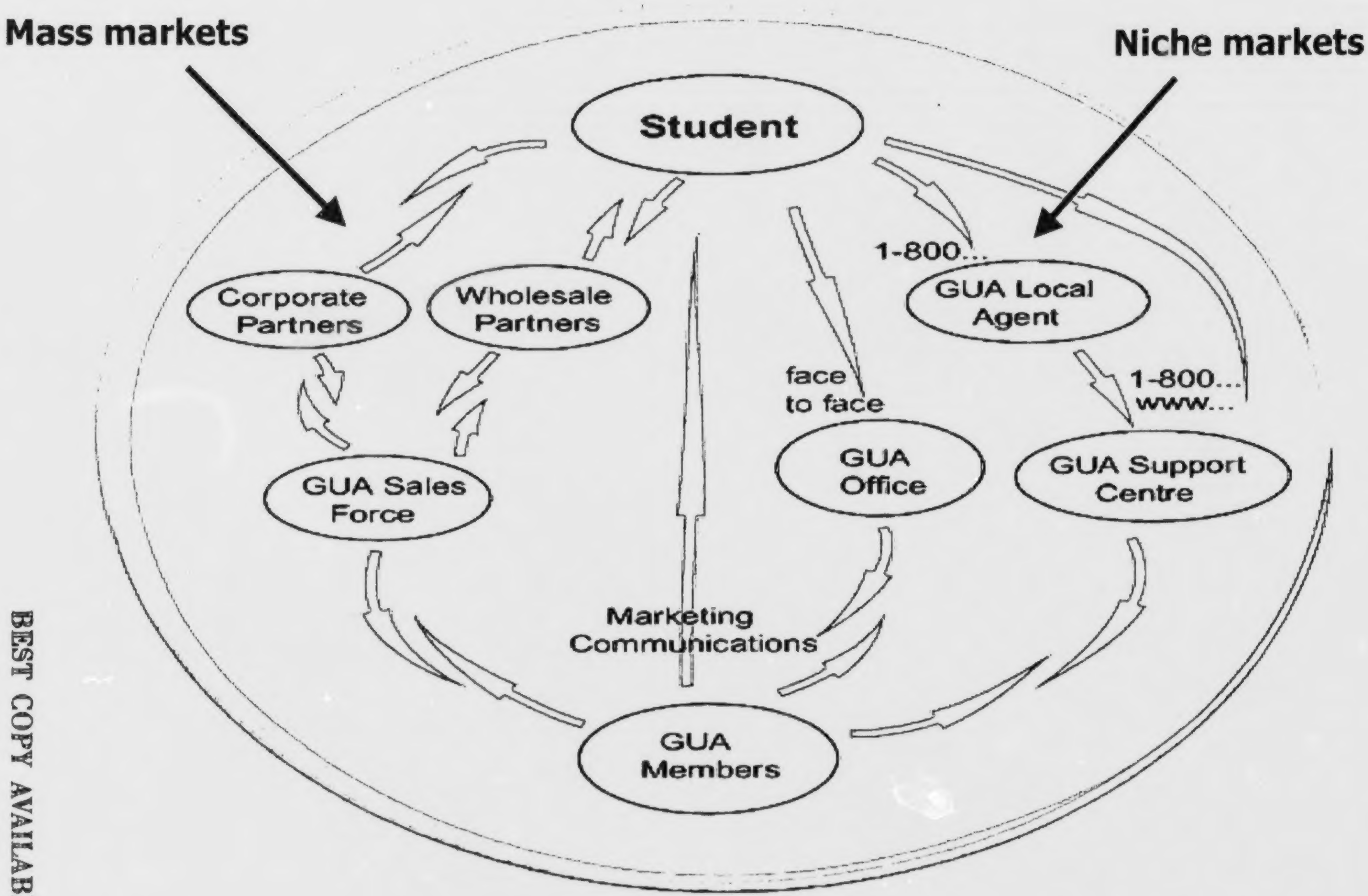
▪ Platform provision	10-30% <
▪ Content	10-30% <
▪ Student support	20-40%
▪ Marketing and sales	10-40% >

D. Market Still Crossing the Chasm

What works in H.E Electronic Delivery

- Provider – Student
    - working nicely in niche markets
- Provider – Corporates
    - where the $ are going
    - works in some areas
- Provider – Distributor – Student
    - taking off, by far the largest market
    - clicks and mortar sales and delivery

Early Majority - Clicks and Mortar



Mass markets

Niche markets

Student
Corporate Partners
Wholesale Partners
GUA Sales Force
1-800...
GUA Local Agent
face to face
GUA Office
1-800... www...
GUA Support Centre
Marketing Communications
GUA Members

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D. New forces in Asian HE industry structure ?

1. **Product**
2. **Production**
3. **Pricing**
4. **Distribution**
5. **Ownership of the customer**

The current model is broken

- Non – available
- Non-scaleable
- High variability in quality
- Customer service a matter of luck

1. The Product is changing

- New products/services emerging
  - Personalization/ customization of product
  - Move from just in case to just in time
  - Changes in delivery – eCRM integration
- Prediction
  - Dramatic new products being launched in Asia
  - Cannot keep on throwing the same old stuff over the fence – not working other than at v. high price points

2. Production must be digitized

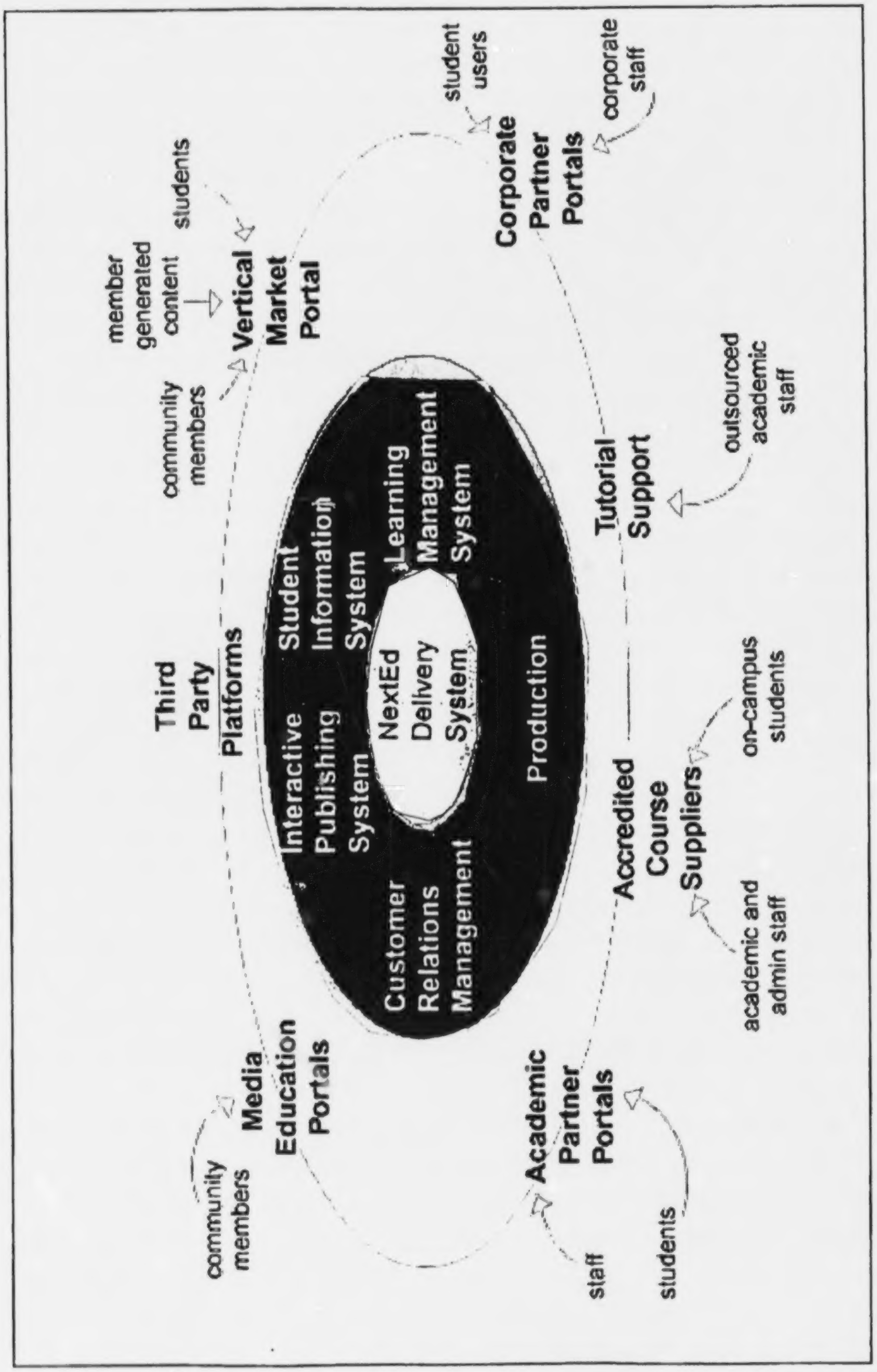
- Customization, personalization and guaranteed quality
- Requires underlying:
  - Digitized infrastructure
  - Customer relationship management system
- Current situation
  - Asian universities tinkering
  - A few Australian universities are serious
  - Asian private colleges advancing

3. Pricing becomes flexible

- Price and income elasticity of demand
  - Strong basis for market segmentation
- Disaggregation of pricing
- Pricing principles
  - Inelastic – testing/award and language
  - Elastic – content
  - Cost plus – labor intensive elements
- Price of content heading to zero

4. Changes in distribution structures

- Historically either Direct sale or independent retail agents
- Dramatic change – the extranet revolution
    - Retail channel extranet integration
    - Direct company/university partnerships
    - Internet based marketing
    - Multi-level marketing – extending the extranet
- Not yet understood in much of HE Sector



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Vertical Market Portal
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student users
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on-campus students
academic and admin staff
Academic Partner Portals
staff
students
Media Education Portals
community members

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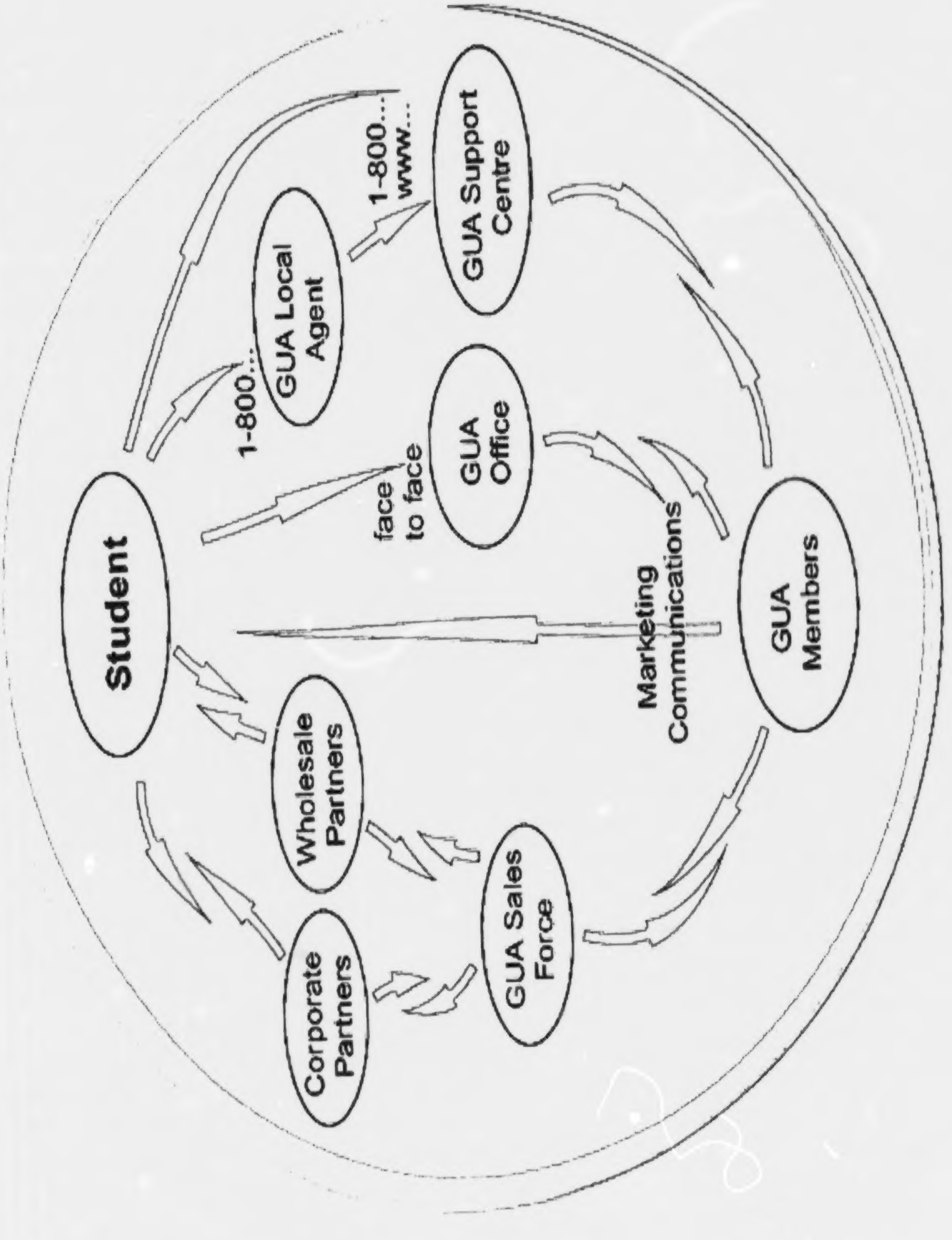
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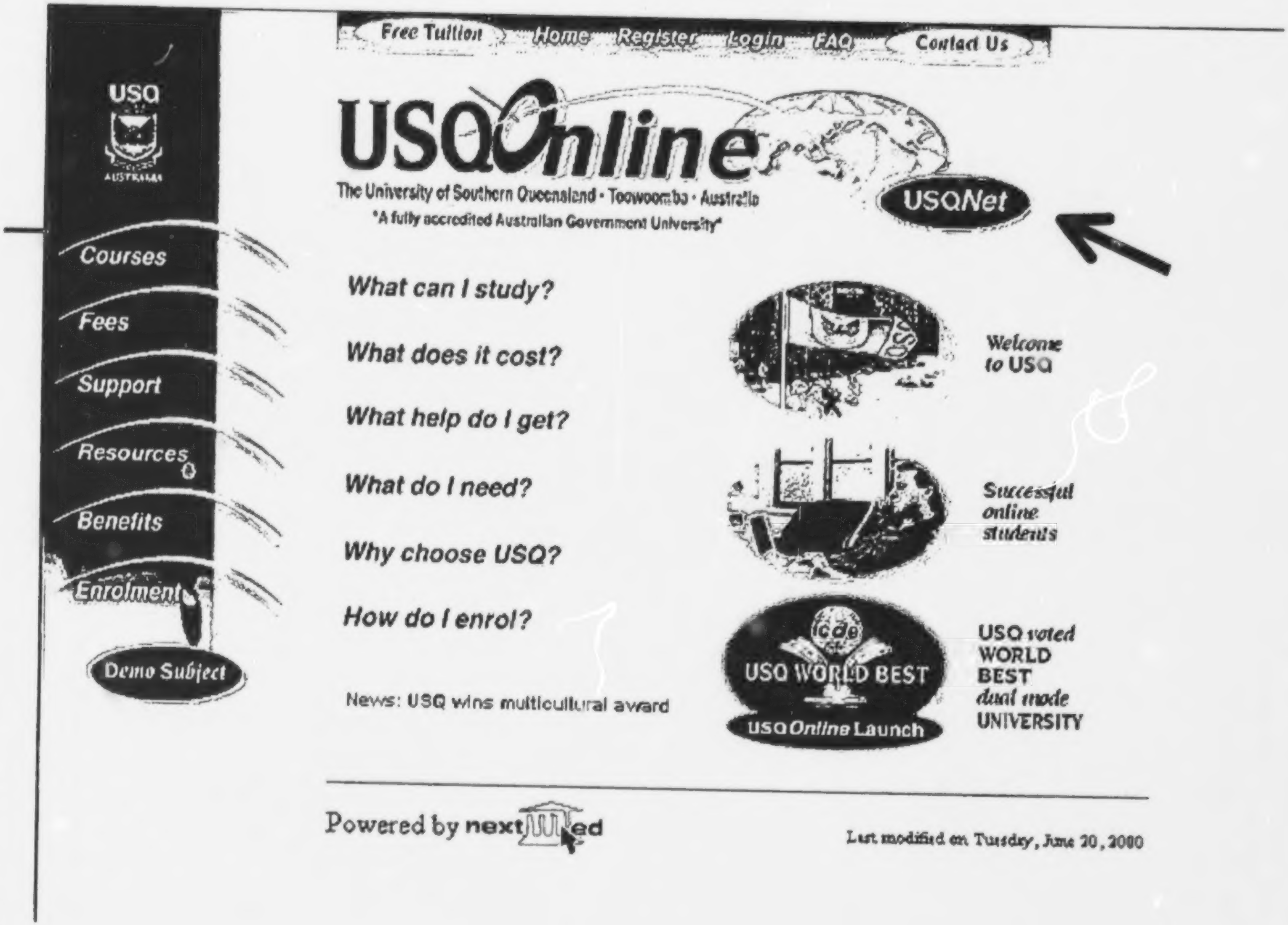
GUA Sales Force


Free Tuition
Home
Register
Login
FAQ
Contact Us
USQ
AUSTRALIA
Courses
Fees
Support
Resources
Benefits
Enrolment
Demo Subject
USQNet
USQ WORLD BEST
icde
USQ Online Launch

USQ Online

The University of Southern Queensland • Toowoomba • Australia

"A fully accredited Australian Government University"

What can I study?

What does it cost?

What help do I get?

What do I need?

Why choose USQ?

How do I enrol?

News: USQ wins multicultural award

Welcome to USQ

Successful online students

USQ voted WORLD BEST dual mode UNIVERSITY

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Electronic distribution partnerships

China

Sinohome.com 中国家庭网

中国电信 CHINA TELECOM

教育在线 WWW.ANBOW.COM.CN

china901.com 中华教育在线

首都在线 Capitalonline http://www.263.net

5 million members

Hong Kong

scmp.com	**400,000 members**
hongkong.com	**1,000,000 members**
ESDlife 生活易	**Sole provider of online government services**
futurestep	**800,000 CVs**

Singapore

IQmind.com

Over 300,000 members including teachers and parents

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5. Primacy of Customer Segment Management

- Emergence of vertical market learning communities
- Entity which owns the student owns the game
  - Are traditional H.E institutions going to allow distributors to own?

6. What do you want to be?

- Totally vertically integrated in particular markets
- Monopolize niche markets
- Learning experience manager
- Content originator
- Alumni learning manager

Conclusion

- Explosive growth – USA missing in action in Asia
- The University as a global extranet
- Disruptive technology = value chain contestability
- The market – still crossing the chasm
- What works today - Clicks and Mortar

Terry Hilsberg

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Fax: +61 2 9966 1929
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Terry has been involved in the venture capital industry for the last 10 years in Japan, China, the USA and Australia, primarily dealing with telecommunications and information technology related investments. Most recently he has become involved in the education industry leading to the formation of NextEd Limited (formerly eEducation Limited). Terry holds a Bachelor of Science and a Master of Town and Country Planning from the University of Sydney.

Back to proceeding page **Back to the sessions page**

Edu-Commerce

Where Education Meets Commerce

Phillip Clark
General Manger
- Strategy and Global Solutions
SCT, Inc., USA

SCT

- $436 Million Corporate Revenue in Software and Services Solutions
- Market Share
  - U.S. market share – 41%
  - Global market share – 17%
- Partners and Investors in Campus Pipeline and WebCT to deliver a comprehensive e-learning solution.
- SCT Vision
  - *To fuel the transformation of education by delivering solutions that enhance client's relationships and achieve significant, measurable performance improvements.*

Knowledge driven economy is creating a new world of education.

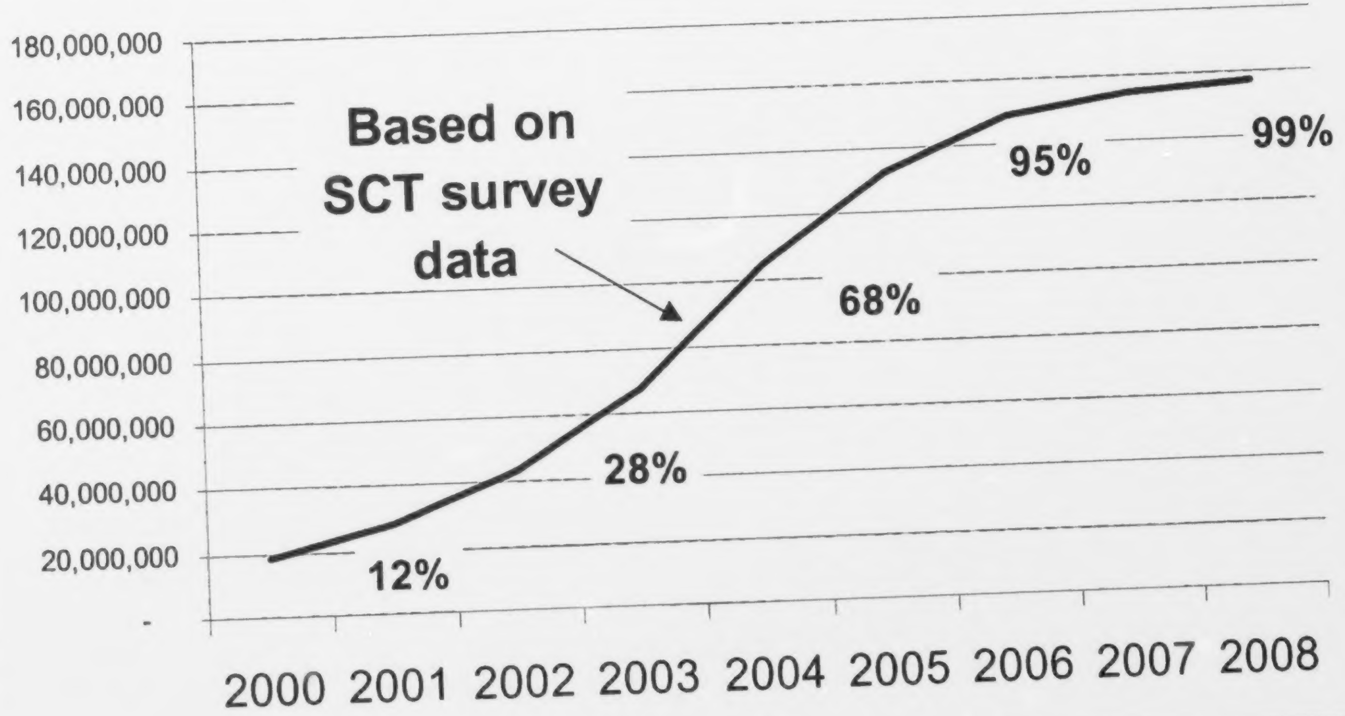
Growing demand for education

New technolog

Explosion in New Learning Solutions

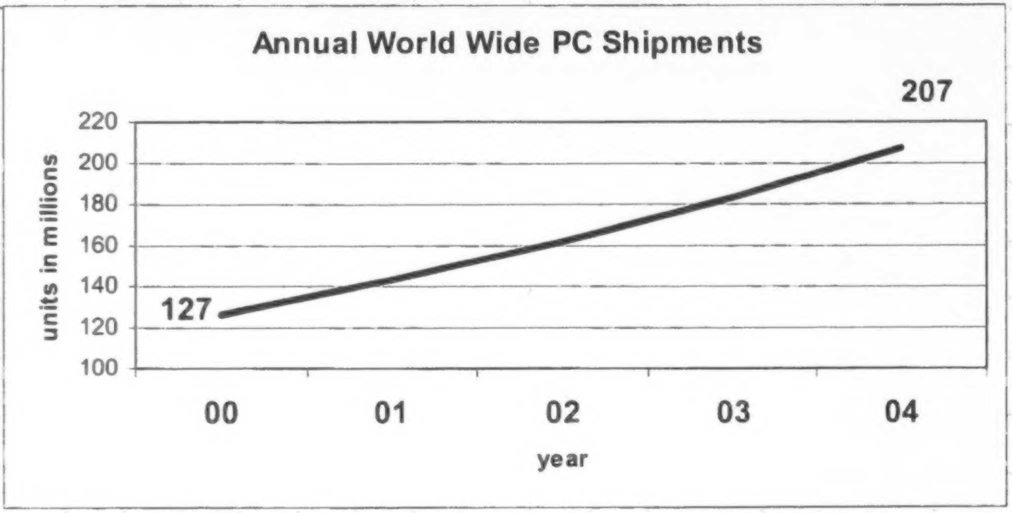
Electronic Learning Is Entering the Mainstream of Higher Education

Estimated Annual Registrations Containing Some Online Content



Based on SCT survey data

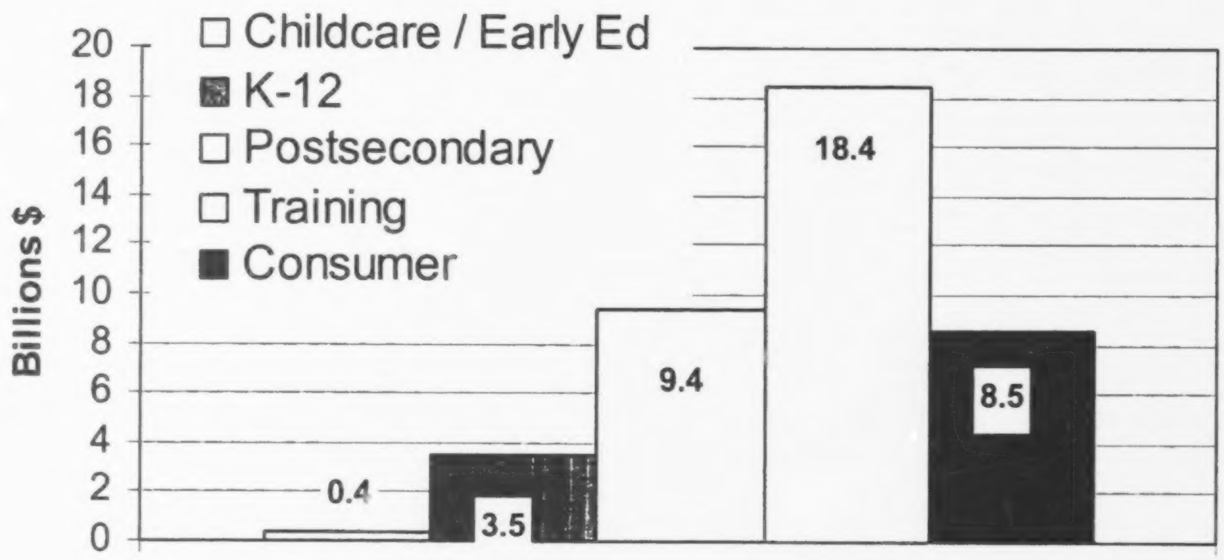
Forecast of PC Shipments by Regions



Region	1999 – 2004 CAGR %
Asia / Pacific	22.2
ROW	14.8
W Europe	11.6
USA	10.6

Estimates of E-learning Market Size

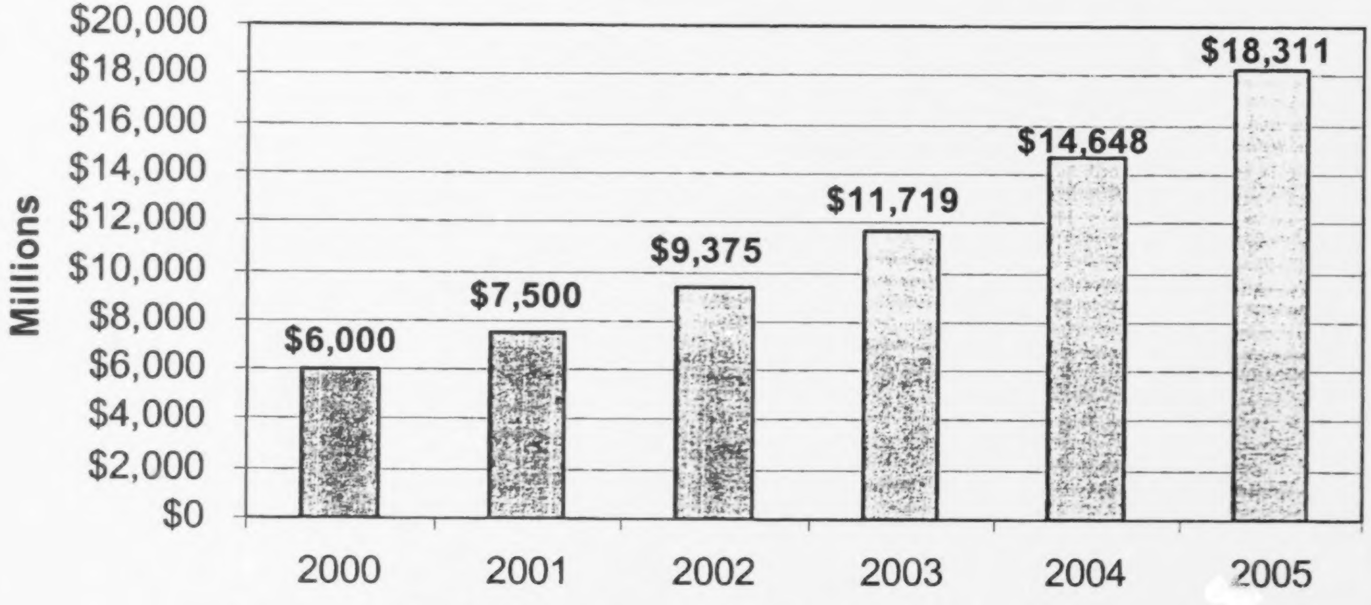
E-learning market estimated at $40 Billion in 2005


E-learning Market Size - 2005

Source: SCFB analysis Mar 2000

E-learning explosion

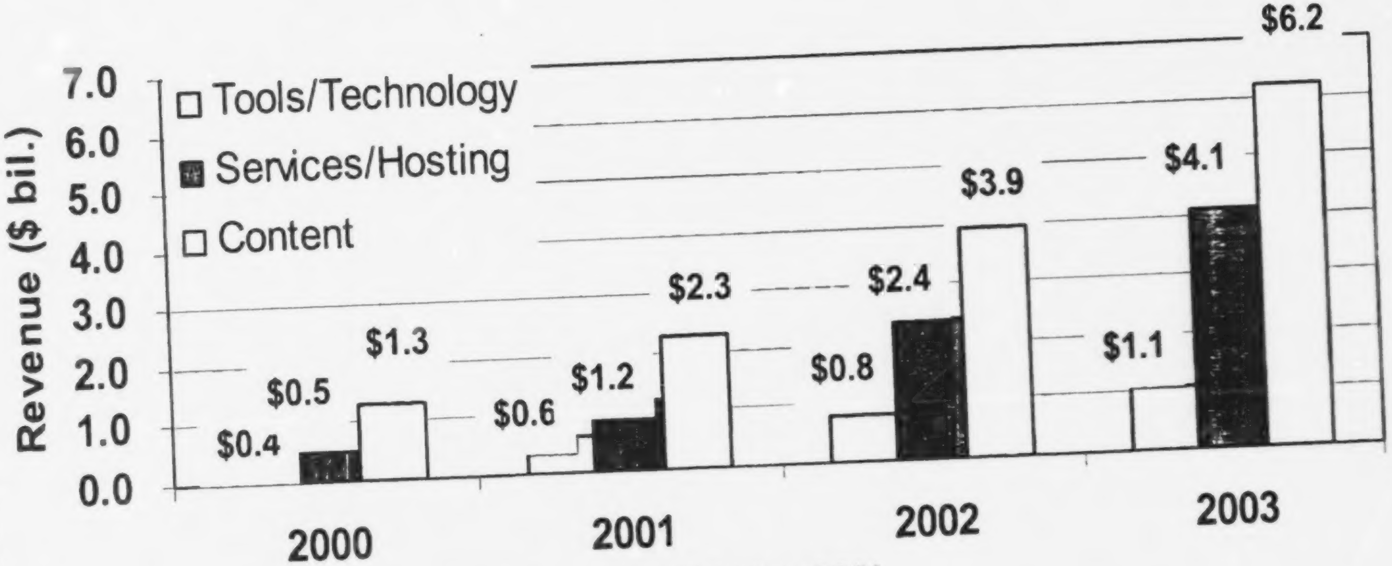
Market Forecast for Distance Education in Asia



Based on NextEd Estimates as reported in Technology Training' June 2000

E-learning Landscape

Growth of the U.S. Internet-Based Training Market, by Market Segment



Combined CAGR: 83%

Source: International Data Corporation, 2000

E-learning Revenue Models

◆ Pay for use	Sale of content for single use
◆ E-Commerce	Sale of products and services
◆ Subscription / Lic.	Sale of content for long term use
◆ Data aggregation	Sale of cust. Data, list, etc.

A question -

If classrooms are no longer needed, where is the opportunity in education?

Five Sectors of the E-learning Market in 2005

Sector	**$ Size**	**% of total**	**Proj. 5 Yr CAGR**
Childcare / Early Edu.	0.4	2%	21%
K-12	3.5	11%	35%
Postsecondary	9.4	29%	35%
Training	18.4	31%	53%
Consumer	8.5	27%	35%

E-learning Business Models

◆ Distance learning	Delivery of content
◆ Portals	Aggregators of services and info
◆ Enablers	Infrastructure – e.g. telecom
◆ E-commerce	Sale of education related products

Edu-Commerce

Click here to start

Table of Contents

Edu-Commerce

SCT

Knowledge driven economy is creating a new world of education.

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E-learning explosion

E-learning Landscape

E-learning Revenue Models

A question -

Five Sectors of the E-learning Market in 2005

E-learning Business Models

Author: Phillip Clark

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Phillip Clark

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Fax: 610-578-3303
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During his first five years with SCT Corporation, Mr. Clark was responsible for managing SCT's Global Education Systems division's strategic product planning and new product development activities. In this role Mr. Clark managed the identification and approval of

products that accounted for 30% of the division's revenue and helped SCT enter the distance education arena. Currently, as part of the corporate marketing staff, Mr. Clark defines and manages corporate wide polices for creating new revenue sources for SCT. Before joining

SCT, Mr. Clark held increasingly responsible positions in technology and marketing companies that provided practical experience in brining products to market. He holds a B.A. in Psychology and an M.B.A. in Finance and Marketing from the University of New Mexico.

Back to proceeding page **Back to the sessions page**

Country / Region

Wednesday, 17 January 2001
1030–1200

W.2.3 South Asia

Location: South Pacific III

Chair: GEORGE LISSANDRELLO, President & COO, Infoserve International, Inc, *USA*

W.2.3.2 Barriers and Opportunities to IT Leadership in South Asia–Sri Lanka, A Case Study (ABSTRACT)

SANTUSHI KURUPPU, Director, Tinggal Interactive (Pvt) Limited, Sri Lanka and JULIE S.Y. CHAR, Knowledge Manager, The Weber Group, Inc., *USA*

W.2.3.3 Emergency Telecommunications for Disaster Mitigation in Bangladesh (ABSTRACT)

FAZLUR RAHMAN, Chairman, and RUMANA TASNIM RAHMAN, South Asia Multi Media, *Bangladesh*

W.2.3.4 Stimulating the Growth of Internet for Acclerating Development in South Asian Countries (ABSTRACT)

N.K. CHHIBBER, Secretary-General, PTC India Foundation, *India*

Barriers and Opportunities to IT Leadership in South Asia-- Sri Lanka, A Case Study

Santushi Kuruppu and Julie S.Y. Char

Abstract

www.webergroup.com

1. Sri Lanka -- An Introduction

Sri Lanka is a country of contradictions, an enigma in South Asia. At first glance, Sri Lanka should be at the forefront, a leader amongst its fellow countries. With a GDP of US$15.3 billion[i], an inflation rate of 4.7 percent[ii], and an unemployment rate of 8.8 percent[iii], "Sri Lanka today is South Asia's most open economy," according to the World Bank.[iv] Sri Lanka also boasts high and improving levels of social development and quality of life with a life expectancy of 73.1 years[v], an infant mortality rate of 15.9 per thousand births[vi], and a literacy rate of 92 percent[vii], the highest in South Asia.[viii] However, despite apparently strong economic and social indicators, things are not as positive as they seem. The country recently devalued its currency from 75 LKR/US$1 to 78 LKR/US$1[ix] in an effort to boost exports. In addition, costs for basics like diesel, electricity, and cooking gas increased by as much as 30 percent,[x] transportation fares are up by as much as 50 percent, and water and telephones by 20 to 30 percent.[xi]

The primary reason for these disparities is the country's 17-year-old civil war between Tamil Tiger rebels in the northeast and the government. The sustained conflict has, without a doubt, cost Sri Lanka economically. In the 1960s, Sri Lanka, Malaysia, and Singapore were at the same level economically and socially. While Sri Lanka has managed to maintain high social indicators, economically its GDP per capita income of $820 is "less than one-third of Malaysia's and one-thirtieth of Singapore's."[xii] The World Bank estimates that the war has drained at least two years of GDP growth[xiii] and the Bank's private sector lending window, the International Finance Corporation, said it believed "Sri Lanka could achieve a GDP growth rate of 10 percent if not for the conflict."[xiv] Sri Lanka has traditionally been a low defense budget country with expenditures being below one-half percent of GDP in the early 1970s.[xv] However, with fighting in early 2000, defense spending increased by US$175 million bringing the total expenditures for the year to US$880 million or approximately 5.2 percent of GDP.[xvi]

In addition, although largely concentrated in the north, the violence and destruction is felt in the capitol of Colombo where suicide bombers target Ministers of Parliament and other official dignitaries. This unstable atmosphere has a direct negative effect on revenue from tourism and foreign investment. Industry analysts estimate that tourism arrivals will decrease by 15 percent from 1999's record 436,400 visitors.[xvii] And Bernard Pasquier, director of the International Finance Corporation's South Asia department said, "'There is a lack of investor confidence due to the ongoing conflict,' adding that a speedy solution was imperative."[xviii]

The war continues despite its negative, draining effects and international consensus that it must be resolved as soon as possible. An interesting contributing factor is that much of this war is concentrated on the poor and lower middle class. The upper middle class and the extremely wealthy (referred to as the Colombo crowd) are not directly affected by the war. This discrepancy is manifested because the political and social influence is concentrated disproportionately with this small percentage of society. The sons and daughters of this segment of society do not engage in combat or military service. Life, on the whole, is not disrupted, therefore, the commitment and dedication to end the war is not a priority.

In addition to the civil war, Sri Lanka suffers from a large public sector wage bill that further burdens the economy. Progress in privatizing water and electric utilities as well as the state-owned Ceylon Petroleum Corp. has been slow. Economists from the World Bank point to the successful privatization of plantations and the telecommunications sector, which recorded high growth rates as a result of privatization[xix], and hope that the country will continue in this direction.

Despite its set backs, Sri Lanka will need to take advantage of the current economic and technologic environment to help elevate it from its current status as a developing country and take its place beside the prosperous nations in Asia, perhaps even becoming one of the Asian tigers.

2. *The New Cyber-Economy: What it Takes to Get There*

What are some of the factors that allow a country to take advantage of the new cyber-economy? The following is a short list of factors that are attributed to establishing South Korea as a "cyber-tiger" of Asia.[xx] And while South Korea is hardly considered a "developing country" -- the fundamentals remain the same.

- **High education levels and technological sophistication** -- for obvious reasons, a country must first educate its population before it can hope to move into the technology arena. With children who routinely score at the top internationally in math and science and a university-educated population as widespread as in the West, South Korea has a base of highly educated, well-prepared people ready to lead and participate in the technology sector.
- **Government support** -- the government must create a regulatory and legal environment favorable to the technology sector. Creating laws and regulations that specifically address issues like e-commerce, intellectual property rights, and cyber-privacy does this. The government can take things a step further by mandating, as did South Korean President Kim Dae Jung, that government offices must make half of its purchases online.
- **Restructuring of government and business to enable e-commerce** -- This point encompasses the first two but also extends the responsibility to the private sector. In addition to the government creating the tools (an educated population) and the environment necessary to foster e-commerce and Internet growth, private businesses must also make changes to keep up with this rapidly changing world. "Radical solutions will be needed to change inefficient distribution, educational and telecommunications infrastructures which currently impede commerce."[xxi] Many "brick and mortar" companies in the U.S. and Europe have had to reevaluate and reinvent themselves in order to remain competitive. Companies in developing countries must do the same with the added burden of establishing partnerships with Internet brands like Lycos, Yahoo, Amazon.com, and eBay.
- **Cost structures that favor the Internet** -- The average household and business must be able to afford access to the Internet. In a country like Sri Lanka an "Internet-ready" computer (550mHz PIII, 5GB hard drive, 32RAM, CD, modem, and monitor) costs LKR 65,000 or US$833 while an average 12-month Internet/email usage package costs LKR 12,000 or US$156. This does not include the telephony charges on top of Internet access. With an average per capita income of $820, a computer is more than just a luxury item; it is a dream that won't be realized.

3. *How Sri Lanka Stacks Up*

In spite of its 17-year civil war, Sri Lanka has shown an incredible propensity to initiate progress and development. Three examples pertinent to this paper include: 1) the privatization of Sri Lanka Telecom, 2) the introduction of South Asia's first WAP (Wireless Application Protocol) portal and 3) the establishment of free trade zones

3.1 Privatization of Sri Lanka Telecom

In 1998 Sri Lanka became the first country in the region (including Singapore) to privatize telecommunication by giving a 35 percent stake to Nippon Telegraph & Telephone Corporation (NTT) of Japan.
In 1998 it reached a customer base of 500,000, expanding to 600,000 in 1999[xxii] and plans to install another two million telephones by the year 2002.[xxiii] In the past three years, a total of US$500 million has been spent on improving infrastructure. A planned debenture issue of LKR 1.5 billion has been postponed to 2001 due to current market conditions; however, the decision to further privatize shows foresight and future planning on behalf of the government. As a result, infrastructure, customer service, and the endless waiting lists to receive a connection have been drastically reduced.

Private interests feel that the government could be doing more to promote infrastructure expansion. Sri Lanka's two leading private telecommunications operators, Lanka Bell Ltd. and Suntel Ltd., are urging the government to further remove barriers that will continue to protect Sri Lanka Telecom through 2002.[xxiv] By doing so, this would open up more opportunities and connections to the Internet.

> "Although the fixed wireless was introduced early on, Sri Lanka Telecom (SLT - with the Government still the largest shareholder) still holds the monopoly over local and international voice traffic until 2002. This makes the playing field unequal to the favor of SLT. Unlike Singapore where once telecom was privatized the competition has equal access to the infrastructure and the business," says Vijendran Watson, former Managing Director to Lanka Bell (Pvt) Ltd.[xxv]

Not only is the international voice traffic an issue to fixed wireless operators but the inter-connectivity fee shared by all operators is being held by SLT.

> "Lanka Bell investors have stopped investing further monies into developing our network due to SLT's high interconnection fees among other issues of contention. Furthermore, we are paying a significant percentage of our earnings to SLT. Due to all these issues our current network extends only from Negombo, to the north, and to Galle, in the south, " explains Vijendran Watson, former Managing Director to Lanka Bell (Pvt) Ltd.[xxvi]

3.2 Introduction of South Asia's First WAP Portal

The second achievement of significance is the introduction of a WAP portal by Dialog GSM to Sri Lanka. "Dialog GSM has decided to put Sri Lanka as the fifth nation in Asia on the WAP map," Johan Adler, Managing Director of Ericsson Telecommunications Lanka.[xxvii] WAP information is being introduced to Sri Lanka by Dialog GSM and MediaSolv.com in collaboration with SriLankan Airlines, Media Solutions, Pizza Hut, DHL, Avakasakade, GTE Yellow Pages, Union Bank, Cricinfo.com, Hotel Lañka Oberoi, Siam House, and Pearl Video.[xxviii] The new service would provide customers a guide to cities with WAP technologies, enable them to do banking transactions, obtain flight information, and foreign exchange rates among other features. Access to international WAP sites is also included.[xxix]

Says Philippe Kubbinga, Director Product Marketing of Ericsson Consumer Products Asia Pacific:

"Sri Lanka has every right to have access to this technology. We have to take the responsibility for educating the public. It is a responsibility for all. I hope that the authorities such as operators and the government, embrace the technology."[xxx]

3.3 Establishment of Free Trade Zones

The third accomplishment of note is the expansion of free trade zones and the work of the National Board of Investments. Under the direction of Thilan Wijesinghe since 1995, the government has added ten free trade zones to the four that existed when he first took office.[xxxi] By exempting companies from taxes and tariffs, the government has been able to secure commitments from companies like Sun Microsystems which will invest US$10 million in a software development center. The board also offers incentives for companies to invest in schools to train Sri Lankans in computer programming and other information technologies.

Most recently Sri Lanka and South Korea launched a free cyber-trade zone which will enable the two countries to conduct trade and joint ventures over the Internet.[xxxii]

3.4 Other Positive Indications

And there are other, smaller indicators that show that Sri Lankans are making progress:

- NIIT Ltd., an Indian software and education firm; Sri Lanka's Mercantile Merchant Bank Ltd.; and the Maharaja Group recently announced the launch of several IT training centres. The venture has the support of the government's Board of Investment (BOI) and will incorporate the latest e-commerce and Internet technologies. The BOI hopes to establish Sri Lanka as experts in specific spheres in the IT arena like Java, multimedia, and e-commerce.[xxxiii]
- Local companies like Millennium Information Technology, a software development company; eRunway, a provider of e-business and market strategies as well as a number of complimentary Internet services; and SasiaNet (Pvt.) Ltd., which offers an online rooms booking engine to resellers, are making their mark on the global stage. eRunway is also making a conscious effort to select local talent by hiring much of its technical staff from Sri Lanka's universities.[xxxiv]
- Seylan Bank announced a LKR 400 million project to develop Internet banking and e-commerce.[xxxv]
- Sri Lanka's Minister of Posts, Telecommunications and Media, Mangala Samaraweera announced that Cyber Net Cafe Centres would be opened in every district in the country, especially for the benefit of youth.[xxxvi]
- Ceylinco launched e-ceylinco in 2000. A business-to-business (B2B) site, it is membership driven for companies or individuals to buy, trade, and sell products. The development and maintenance is done in

Malaysia even though the company is Sri Lankan.

3.5 Existing Barriers

Sri Lanka still has a ways to go. To date there are no laws, regulations, or taxes dealing specifically with e-commerce or the Internet. Banks have recently started discussing the possibilities of recognizing online transactions as valid. Current laws do not recognize any credit card transaction unless a signature accompanies the transaction slip. Needless to say, this severely hinders any e-commerce ventures within the country. If the company has a foreign bank account then transactions are recognized (for example, www.lankalink.lk offers a selection of items for sale online, is registered in Sri Lanka, and its accounts are held in a foreign bank).

Currently telecommunications issues fall under the jurisdiction of the Sri Lanka Telecommunications Regulatory Commission. And while Sri Lanka takes a very serious view of intellectual property rights, it does not consider data as goods and therefore does not extend protection to computer programs, databases, and semiconductor designs.[xxxvii] And in spite of its official view, very little is done to limit the distribution of pirated software, which is freely available for purchase throughout the country.

Connectivity infrastructure is yet another barrier. Despite the progress made by Sri Lanka Telecom, fixed-lines reach only two percent of the 18.8 million inhabitants (well below the world average of ten percent and the developed world average of 50 percent).[xxxviii]

4. What About India?

With a population close to one billion and an environment favorable to high technology as a tool for economic growth, many see India as the next big e-business market, second only to Japan and China.

"While much of the internet growth seen in China and India is due to the sheer sizes of these countries, going forward, it will be alternative forms of internet access, such as cable modem and wireless access which could drive these countries to the forefront of the internet marketplace," said Brian Gilman, senior research analyst at eMarketer. "Today, areas of China and India are not properly wired for traditional phone access. These countries boast two of the largest cellular phone and cable television markets in the world and that alone may allow them to become the next Asian internet powerhouses," he said.[xxxix]

Without a civil war to distract the government from its domestic agenda, India is ahead of Sri Lanka and has made significant progress in several areas.[xl]

4.1 Education and technology sophistication

Every year India's university system produces 240,000 engineers. In addition, ever since the 1970s, India has maintained strong ties with the United States and Silicon Valley. In a study done by Anna Lee Saxenian at the University of California at Berkeley on the role of immigrants in Silicon Valley, she found that at the end of 1998, 771 companies were Indian-run. It is estimated that the figure is now closer to 1,000. In addition, several thousands of Indians hold senior positions in top technology companies in California, Massachusetts, and Washington. They are taking their connections and skills to help build operations in their home country as well as sourcing business from India.[xli] Given these two factors, there is a large, well-educated, and well-connected base of IT talent from which to draw.

"India is the world leader in offshore software development. According to Nasscom, 184 companies from the Fortune 500 outsourced some of their needs to India."[xlii]

4.2 Government Support

India's government has created or is in the process of creating several laws and regulations to structure and foster IT growth. Among them are:

- Passage of the Information Technology Bill on June 16, 2000, which gives legal recognition to digital signatures and sets penalties for cybercrimes.
- Easier ways for startup companies to go public -- firms with at least ten percent venture capital funding may go public.
- Developing standards for WAP for online trading.
- Formally approved online trading of shares.
- Relaxed rules on foreign direct investment in the e-commerce sector and for startup companies trying to go public:

  - 100 percent foreign equity will be allowed in business-to-business (B2B) ventures, provided that 26 percent of holdings are divested to the Indian public within a five-year period.

  - Business-to-consumer (B2C) ventures are capped at 49 percent foreign equity.
- It is one of the first countries to tax e-business and is in the process of developing full tax regulations for e-commerce and the Internet.

4.3 Infrastructure

- All available bandwidth must be resold through state-owned Videsh Sanchar Nigam Limited (VSNL). This severely limits the amount of bandwidth as VSNL will control allocation until 2004. However, as of April 2000, 17 private companies have been cleared to operate gateways.
- Cable access to the Internet has potential because of India's more than 35 million cable television connections. However this will be costly for two reasons: 1) cable modems are more expensive than regular modems and 2) the cable network is currently set up to transmit one-way signals and two-way transfers are required for Internet access.
- At the end of March 2000 there were an estimated 26 million fixed phone lines installed with 4-6 million annually forecast to be installed. This is a small percentage given India's nearly one billion inhabitants.
- In general, the government's willingness to continue to protect state-owned monopolies (i.e. -- bandwidth, fixed-line services, and domestic long-distance) continues to hinder progress.

4.4 Cost Structures

Cost issues in India are very similar to Sri Lanka making access prohibitive for most of the population.

- Only 19 of every 1,000 people have access to telephone main lines and two of every 1,000 have access to a personal computer.
- Progressive cuts in import duties on computer hardware are expected to reduce computer prices by 15-20 percent a year.[xliii]
- Price for Internet access is very competitive with more than 315 companies holding ISP licenses. However, the average price for monthly access is US$42[xliv], which over the course of the year represents more than 100 percent of per capita GDP of US$440.
- As with other developing countries, India hopes to provide access to the Internet via publicly accessible sources like schools, offices, and cyber cafes. In a study done by the Indian Market Research Bureau, 4.34 million Indians accessed the Internet from sources outside their homes.[xlv] For example, one of the first "professional" cyber cafes in India's capitol city caters to the needs of approximately 1500 people a day with 80 terminals running around the clock.[xlvi] And while speed and reliability remain issues, cyber cafes can be found in almost every major city throughout the country.

4.5 Existing Barriers

Like Sri Lanka, connectivity and cost will remain primary barriers. India is looking to cable and wireless technologies to help alleviate its landline problems but bandwidth will continue to be a problem as long as Videsh Sanchar Nigam Limited controls allocation.

5. Sri Lanka -- The Bottom Line

Sri Lanka is a contradiction to the regular economic development model. It proves that high social development indicators and an open economy do not necessarily mean that economic prosperity is guaranteed. Government negligence and lack of foresight have turned this potential Asian Tiger to a nation struggling to keep abreast of the rapid advances of technology while fighting a war that has eluded victory for nearly two decades. What will Sri Lanka have to do to overcome its obstacles?

- End the civil war -- clearly it is easier said than done. Even with international intervention, a resolution to the conflict eludes the government. There is no doubt that this war has become an albatross around the government's neck. It drains resources and distracts attention from the necessary tasks the country needs to move forward.
- Create a master IT plan -- as illustrated, pockets of success exist in Sri Lanka -- from private companies to cyber free trade zones. However, the government needs to address all levels -- from education to infrastructure to specific laws and regulations that no longer protect monopolies but truly frees the nation's businesses to embrace e-commerce. Again, this is a task easier said than done but with a formalized plan of action, the government can set deadlines, goals, and milestones that will

progressively move the country forward.

- Increase Internet access -- this can be accomplished in a number of ways:

  - Make it easier to access the Internet outside of the home -- whether it is through schools, offices, or the creation of cyber cafes that reach into the smallest of villages. It's not necessary, and financially impossible, at this time for individual households to own a computer, so the government needs to make access more publicly available.

  - Create regulations that encourage the creation of cyber cafes and other public access sites -- the government doesn't have to take on the full responsibility of providing actual access terminals.

  - Reduce import tariffs and taxes on computer hardware -- in order to encourage more homes to purchase equipment, the government should reduce import tariffs, helping to drive down prices.

6. Conclusion

In an e-business readiness assessment conducted by the Economist Intelligence Unit (EIU) of 60 countries, Sri Lanka ranked 52nd, just behind China at 51 and India at 50 -- two of the largest emerging markets. In evaluating each country, EIU looked at the general business environment and "connectivity." And while both India and Sri Lanka scored in the moderate range for general business environment (i.e. strength of economy, political stability, regulatory climate, taxation policies, and openness to trade and investment), they both scored very poor in connectivity. As stated by the EIU, "In the digital age, the state of the communications infrastructure is vitally important. Without adequate Internet access, e-business simply cannot happen."[xlvii] This last statement really underscores the challenges that India and Sri Lanka face -- creating and updating an outdated infrastructure to support the new e-business. Unfortunately for Sri Lanka, it has one more giant hurdle to face -- the resolution of its civil war.

Sri Lanka has always demonstrated a propensity to survive and the tenacity to keep moving forward despite adversity. It has never, unfortunately, quite reached its full potential. With comprehensive IT vision for the future and follow-through implementation, Sri Lanka has the opportunity to become a leader in South Asia and a driving force in the region.

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Back to top of page **Back to the sessions page**

Santushi Kuruppu

Director
Tinggal Interactive (Pvt) Limited

Santushi Kuruppu is Director and founder of Tinggal Interactive, a web development company in Sri Lanka. She oversees all aspects of the company's operations that has completed projects for clients including Shell Gas Lanka Limited, George Steuart & Co. Ltd, and Hayleys Electronics Limited.

Ms. Kuruppu was graduated from Boston University with a M.S. in International Public Relations. She also received her B.A. from Bard College, NY in Political Science.

Back to proceeding page   **Back to the sessions page**

Julie S.Y. Char

Knowledge Manager
The Weber Group, Inc.

Julie Char is the Knowledge Manager for The Weber Group, one of the world's top ten global technology public relations firms with headquarters in Cambridge, Mass. She assists in the planning and development of the company's intranet and its leading application, WeberWorks(sm), a set of proprietary, Web-based, database-driven tools that allow account teams to communicate directly with clients via confidential extranets. WeberWorks was recently recognized by *CIO* magazine as one of the top 50 intranets in the country. In addition, she manages a series of databases and resources for the company.

Prior to The Weber Group, Ms. Char was with Sheila Donnelly & Associates, a Honolulu-based PR consultancy.

This is Ms. Char's second presentation at a Pacific Telecommunications Conference. She last presented her paper, "International Special Interest Computer Networks" at PTC '95.

Ms. Char was graduated from Boston University with a M.S. in Public Relations. She also received her B.B.A. from the University of Hawaii at Manoa in Marketing and International Business.

Back to proceeding page   **Back to the sessions page**

Emergency Telecommunications for Disaster Mitigation in Bangladesh

Fazlur Rahman and **Rumana Tasnim Rahman**

Abstract

www.drik.net/samm-bd

Because of unique geographical situation, natural hazards like floods, tornadoes, cyclones and storm surges often visit Bangladesh. At least 34 cyclones and storm surges ravaged the coastline over last four decades, claiming more than five hundred thousand lives. Disastrous effects of cyclones, floods and other natural hazards affect millions of people in Bangladesh as well as its development activities. Although it is not possible to prevent such calamities, it is however possible to mitigate the impacts of the calamities significantly with improved preparedness and well-planned arrangements to cope with the emergency situation. The objective is to combat the natural disasters towards reducing the loss of lives and properties and helping quick rehabilitation.

The riverine flood in 1998, one of the worst of the century, inundated two-thirds of Bangladesh for more than 75 days, damaged crops, physical infrastructure and assets worth over US $ 2.5 billion. The United Nation apprehended 2 million deaths aftermath the 1998 flood, but in reality the deaths were less than 2000. The tropical cyclone in April 1991 which had winds over 225 kilometers per hour and a storm surge over 7 meters high resulted in about 138000 deaths. However, the deaths after 1999 cyclone [of a similar severity] have been marginal compared to the colossal calamity after 1991 cyclone.

Flood in Bangladesh
10 September 1998

Given the reality of recurring disasters visiting Bangladesh regularly and having comparatively a meager physical infrastructure and poor telecommunication network, [only 0.5 person has a telephone out of 100 people], Bangladesh has fairly well developed procedures for managing the consequences of natural disasters. It has made considerable efforts in organizing disaster relief operations within the limits of the resources available.

The major natural disasters to which Bangladesh is subjected are cyclones, floods, riverbank erosion, tornadoes, droughts, earthquakes and arsenic contamination in groundwater. Population density and the number of people 'at risk' are increasing in all parts of the country. The pressure on land is such that newly accreted char land is immediately occupied for agriculture. The coastal area also attracts large number of seasonal workers.

Concept of Disaster Management

Disaster Management includes all aspects of planning for and responding to disasters. It involves the management of both risks and consequences of disasters and includes prevention / mitigation, protocols, emergency response and post disaster reconstruction and rehabilitation. Bangladesh is now in the process of designing a Comprehensive Disaster Management Programme (CDMP) with the aim to complement and further rationalize existing management activities, projects and plans in such a way as to help remedy recognized shortfalls or deficits that impede the attainment of a more efficient reduction of disaster risks and impacts. Comprehensive Disaster Management is an integrated series of management practices and activities, which attempt to reduce the risk or magnitude of disaster events, and enable individuals and communities to cope with and recover from disasters once they have occurred. The activities covered by Comprehensive

Disaster Management are commonly referred to as prevention, mitigation, preparedness, relief and response, rehabilitation and reconstruction.

Disaster Management Plan (Standing Orders on Disaster)

The Standing Orders on Disaster issued by Ministry of Disaster Management and Relief, Government of Bangladesh (August 1999) provide details of duties and responsibilities regarding disaster management at all levels, including those of Deputy Commissioners, Thana Nirbahi [Administrative] Officer (TNO) and Chairman, Union Parisad. The National, Divisional, District and Thana level government and private agencies get proper guidelines from this book in times of disasters. The Standing Orders provide the guidelines for activities by all concerned during Normal times, Precautionary and Warning stage, Disaster stage and Post - Disaster stage.

This initiative is normally a combined effort of both government and non-government organizations; the challenge is too big to be faced single handedly. The partnership is crucial for devising different disaster management strategies and organizing training programs for personnel involved in implementing them. Alongside community participation is essential for helping the agencies concerned to ensure that the affected people move in time to the shelter centers and that they receive health and hygiene support in the post-disaster period. The longer term plan incorporate tree plantation, particularly in coastal areas. Participation of the rural people in various micro finance projects is helping relieve the distress to a significant extent, especially in char [island in rivers] and haor [inland deep low lying areas]. Everything is done keeping in mind crop failure, shrinking job opportunities for daily labors and loss of lives.

Disaster Action Plan and **Telecommunications**

Disaster Action Plan and Telecommunications are two essential aspects of disaster management. *"In all emergency operations, high-risk decisions must be taken early on, often based on unverifiable government estimations. Facts change wildly from day to day. Search and rescue, medical relief, food aid, shelter and rehabilitation issue all [have] to be assessed and prioritized almost simultaneously.* [1]"

In rescue and relief operations, the time is limited. Post-disaster chaos and limited resources during such situation impose highest demands on the management, logistics, and coordination efficiency. The necessity of rational use of available resources in uncertainty conditions require often a series of consecutive assessment, analyses, and decisions, all in a very short time. Quick action is crucial, as any delay is likely to accelerate loss of life or property. Rescue and relief operations require coordination and consultations, often not available in the field at the time when they are needed. This is only possible through **Emergency Telecommunication**. "*Disaster management must be envisaged in a holistic manner, as a continuum from prevention to preparedness, mitigation and response* [2]".

The primary objective of a **Disaster Action Plan is** to improve the capacity of decision-makers to take needed action. It requires concerted planning, organizing, controlling and influencing of human, material and information resources to ensure that information is disseminated to the right decision-makers at the right time to satisfy those needs.

Telecommunications, on the other hand, is the equipment and networks used to transport information from point to point. Telecommunication is an indispensable tool for disaster mitigation and for co-ordination of international and national responses to disasters. Emergency Tele-communications or Tele-communications for Disaster Management are required to satisfy the needs of humanitarian assistance before, during and after emergencies.

Damaged MW Tower
April 1991

But, Telecommunication links can get disabled and disrupted during the first hours of a major disaster. Following April 1991 cyclone, national and international telecommunications were interrupted due to the collapse of vital microwave tower at the port city of Chittagong. Bangladesh was cut off from the rest of the world for several days before the services could be partially restored.

The major problems related to emergency communications in the field and still waiting for practical solutions, are as follows:

- The problem of safety and security in the field
- The problem of emergency telecommunication services for the affected population.
- Restoration of normal telecommunication services to the affected population after the disaster.
- The compatibility of equipment used in the field by various national and international humanitarian assistance activities.

Forecasting system and mapping the vulnerable areas

The most important step in managing disaster is to strengthen the forecasting system and mapping the vulnerable areas. This helps in minimizing loss of life and property incurred by natural disasters almost every year. The improvement so far made in cyclone related weather forecasting is helping the people of the coastal belt to take shelter in time.

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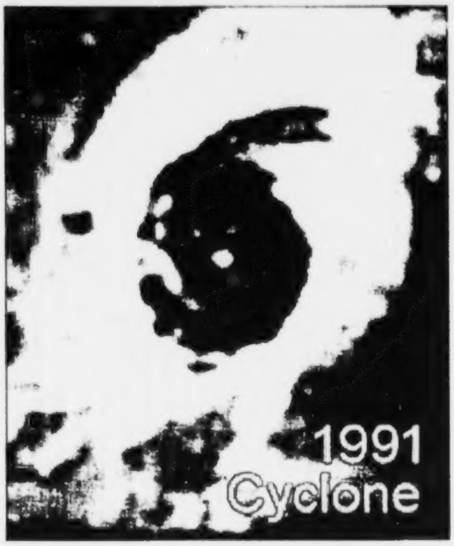
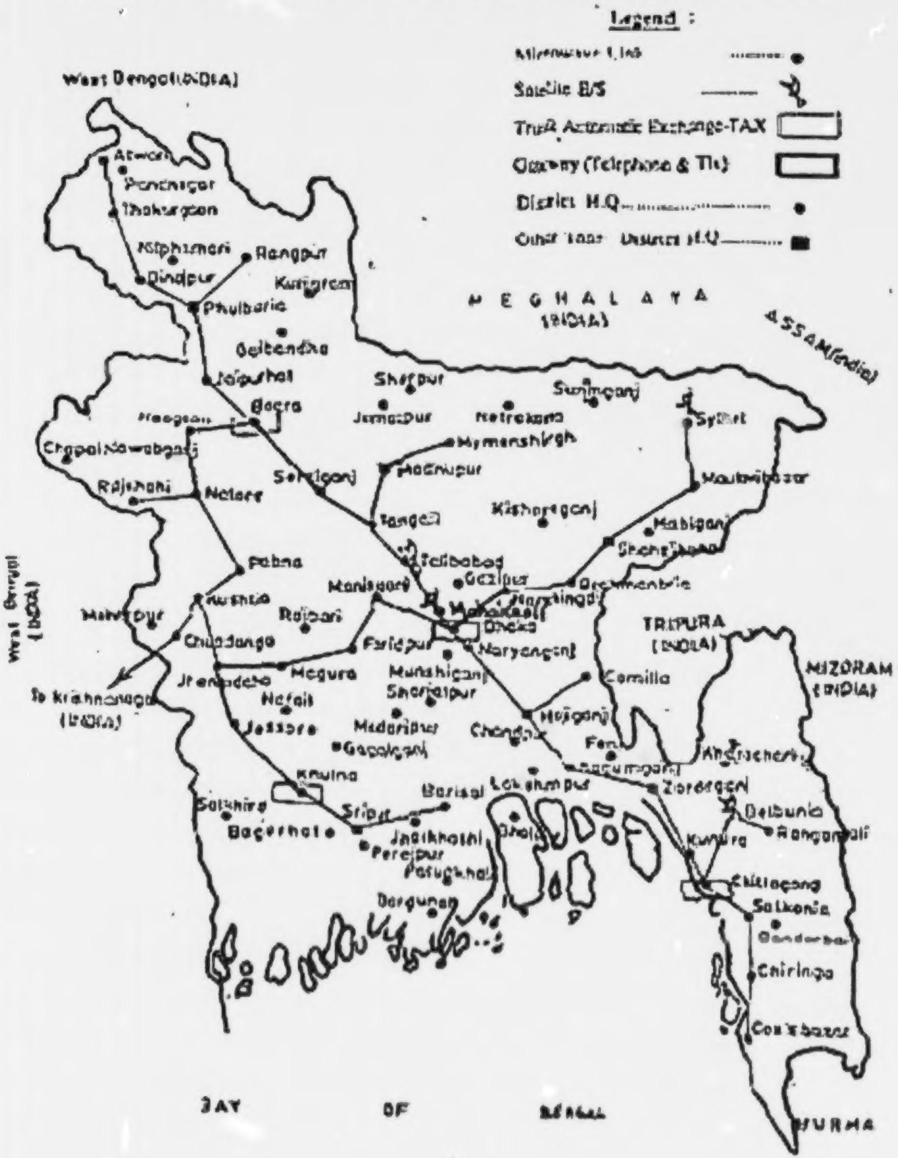


The flood forecasting in 1998, helped Bangladesh to protect and raise the food storages above the danger level as well as to distribute them all over the country well in time. A combination of Satellite, Terrestrial, and High Frequency Telecommunications along with Internet are being used for the purpose.

Telecommunication Networks in Bangladesh

BTTB Networks

MICROWAVE NETWORK in BANGLADESH


Legend :
Satellite B/S
District H.Q
MEGHALAYA (INDIA)
ASSAM (India)
TRIPURA (INDIA)
MIZORAM (INDIA)
West Bengal (INDIA)
BURMA
BAY OF BENGAL
Rangpur
Dinajpur
Phulbaria
Bogra
Rajshahi
Natore
Pabna
Kushtia
Rajbari
Chuadanga
Magura
Jessore
Khulna
Satkhira
Bagerhat
Barisal
Faridpur
Madaripur
Gopalganj
Manikganj
Gazipur
Dhaka
Narayanganj
Munshiganj
Shariatpur
Chandpur
Comilla
Feni
Tangail
Mymensingh
Jamalpur
Sherpur
Netrokona
Kishoreganj
Sunamganj
Sylhet
Moulvibazar
Habiganj
Sirajganj
Noakhali
Laksmipur
Khagrachari
Rangamati
Chittagong
Satkania
Bandarban
Chiringa
Cox's bazar
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Barguna
Pirojpur
Jhalakathi
Narail
Jhenaidah
Meherpur
To Krishnanagar (INDIA)
Chapai Nawabganj
Naogaon
Joypurhat
Gaibandha
Kurigram
Nilphamari
Thakurgaon
Panchagar

Bangladesh is a riverine country and Bangladesh Telegraph and Telephone Board (BTTB)'s long route transmission systems are mainly composed of Microwave, UHF and VHF radio links. The use of optical fibre is presently limited within some city areas for interconnecting local exchange and Remote Switching Units (RSU) in Multi Exchange Network. All the Districts are connected with the Capital Dhaka with Microwave Links. Major backbone transmission links in Bangladesh are presently using star formation network structure. BTTB is converting them into mesh networks with a view to having redundancy in the network and to make it more resilient.

The capacity of the backbone Microwave Links are being increased, under a project for digitalization of the Exchanges in the District headquarters. The duplication of the most important link of Dhaka and Chittagong

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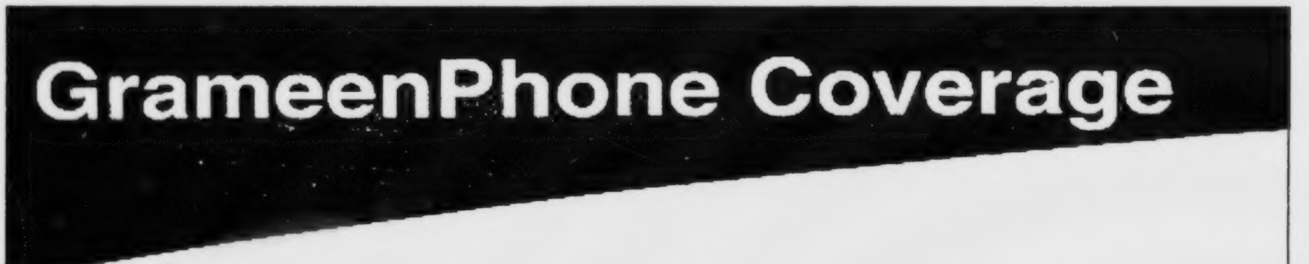
with a fibre optic cable is also in progress. Expansion and rehabilitation programs are in progress for laying a 12 core Optical Fibre Cable between Dhaka and Chittagong, which is the busiest route and is still Analogue.

All Thana headquarters (the smallest administrative units) are connected with their respective Districts through UHF Radio links. Most of such UHF links are now digital radio system. Some of the District headquarters are connected through digital UHF links. Beyond Thana headquarters BTTB has little or no reliable communication links. BTTB has recently taken up Digitalization of all the exchanges in District Headquarters, with provision of Wireless Local Loop (WLL) services from all the exchanges of the Districts of the country. Therefore, soon it will be possible to extend Digital Telephone connections at Upazilla / Thana headquarters and important Village Bazaars. This should provide quality telecommunication services in remote areas of the country.

Networks of Private Operators

Grameen Phone is upgrading the Fiber Optic Cable Network of Bangladesh Railway, available along the Railway route all over Bangladesh. It is establishing the most extensive transmission network in the private sector. Grameen Phone has also established a 140 MBit/s Microwave link between Khulna and Chittagong via Barisal. Grameen Phone (and other GSM Cellular Operators) is required to provide adjacent cell-to-cell Cellular Service. As a result, there is a corridor of areas along the Cellular networks, where Cellular coverage extends. This corridor is about 15 Km wide. Therefore, a significant area, along the Bangladesh Railway track shall be having the coverage of Grameen Cellular service. Further, Grameen Phone has planned to provide Cellular coverage in all the villages of Bangladesh in next 3-5 years period. However, it is not certain, whether this coverage will extend to the areas where Cyclone Shelters are located.


GrameenPhone Coverage
Bangladesh
Existing Coverage
Coverage by 2000 - 2001
PANCHAGARH
THAKURGAON
NILPHAMARI
LALMONIRHAT
DINAJPUR
RANGPUR
KURIGRAM
GAIBANDHA
JAIPURHAT
SHERPUR
NETROKONA
SUNAMGANJ
SYLHET
NAOGAON
BOGRA
NAWABGANJ
RAJSHAHI
NATORE
TANGAIL
HABIGANJ
BAZAR

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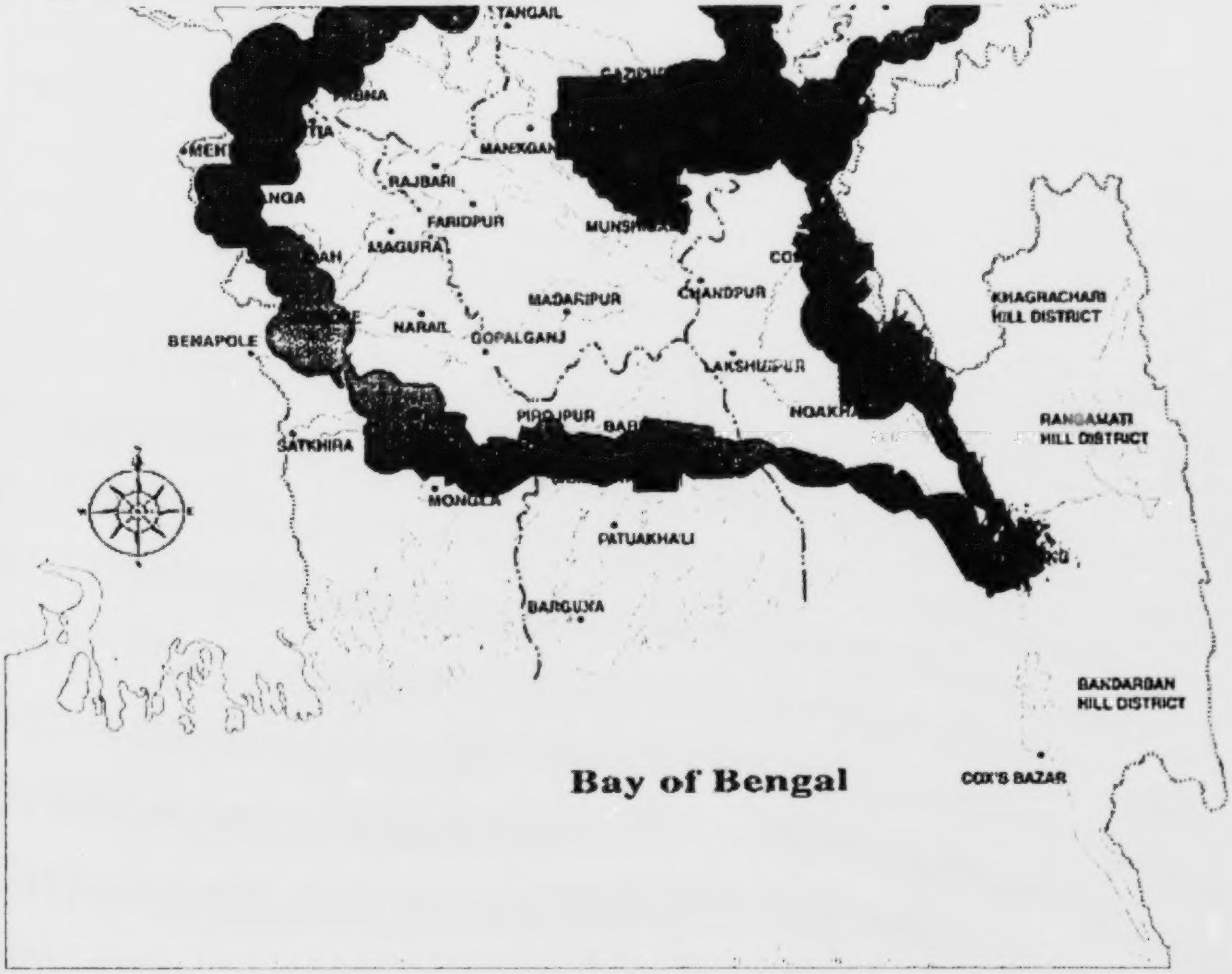
TANGAIL
PABNA
MANIKGANJ
RAJBARI
FARIDPUR
MAGURA
MUNSHIGANJ
CHANDPUR
MADARIPUR
NARAIL
GOPALGANJ
BENAPOLE
LAKSHMIPUR
NOAKHALI
KHAGRACHARI HILL DISTRICT
RANGAMATI HILL DISTRICT
PIROJPUR
SATKHIRA
MONGLA
PATUAKHALI
BARGUNA
BANDARBAN HILL DISTRICT
Bay of Bengal
COX'S BAZAR

Private Telephone Operators of Bangladesh, namely, Grameen Phone Limited (GP), TM International Bangladesh Limited (TMIB), Pacific Bangladesh Telecom Limited (PBTL), Sheba Telecom Limited (Sheba) have Licenses to provide Cellular Services all over Bangladesh. Bangladesh Rural Telecom Authority (BRTA) and Sheba Telecom Limited provide PSTN services in rural areas of Bangladesh. Another Operator, namely, Bangladesh Telecom Limited (BTL) provides Paging and Riverine Telephone Services. The networks of these Private Operators are independent of each other's and there interconnections are done directly, i.e. by-passing BTTB Telephone networks. Lack of stable power supply in the country mandated all the Telecom Operators to provide stand-by power supplies and this has made all the Operators less dependent on the commercial power supply from Power Development Board (PDB). As a result there are in-built redundancy in the network and therefore they are less prone to total breakdown in time of in any disaster.

Telecommunications for Disaster Management or Emergency Telecommunications

Over the years Bangladesh is establishing an increasingly resilient Telecommunication network for the general public, as well as a Disaster Proof Telecommunication Network for comprehensive calamity management. The Telecommunication Networks in Public and Private sectors are independent of each other and are designed to withstand natural calamities like cyclone and flood as well as periodical power failures as routines. More and more reliance is put on wireless technologies like Cellular, Wireless Local Loop (WLL) for penetration in the disaster prone areas. For comprehensive calamity management purposes, disaster proof high frequency

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telecommunication is still being used.

Although the National Telecommunication Network of BTTB and the Telecommunication Networks of the Private Operators are independent of each other, and thus providing redundancies, Bangladesh has established two separate Disaster Proof High Frequency Communication Systems for (i) Cyclone Preparedness Programme (CPP) and (ii) Red Crescent Society.

Operations of the Emergency Operation Centre / Control Room

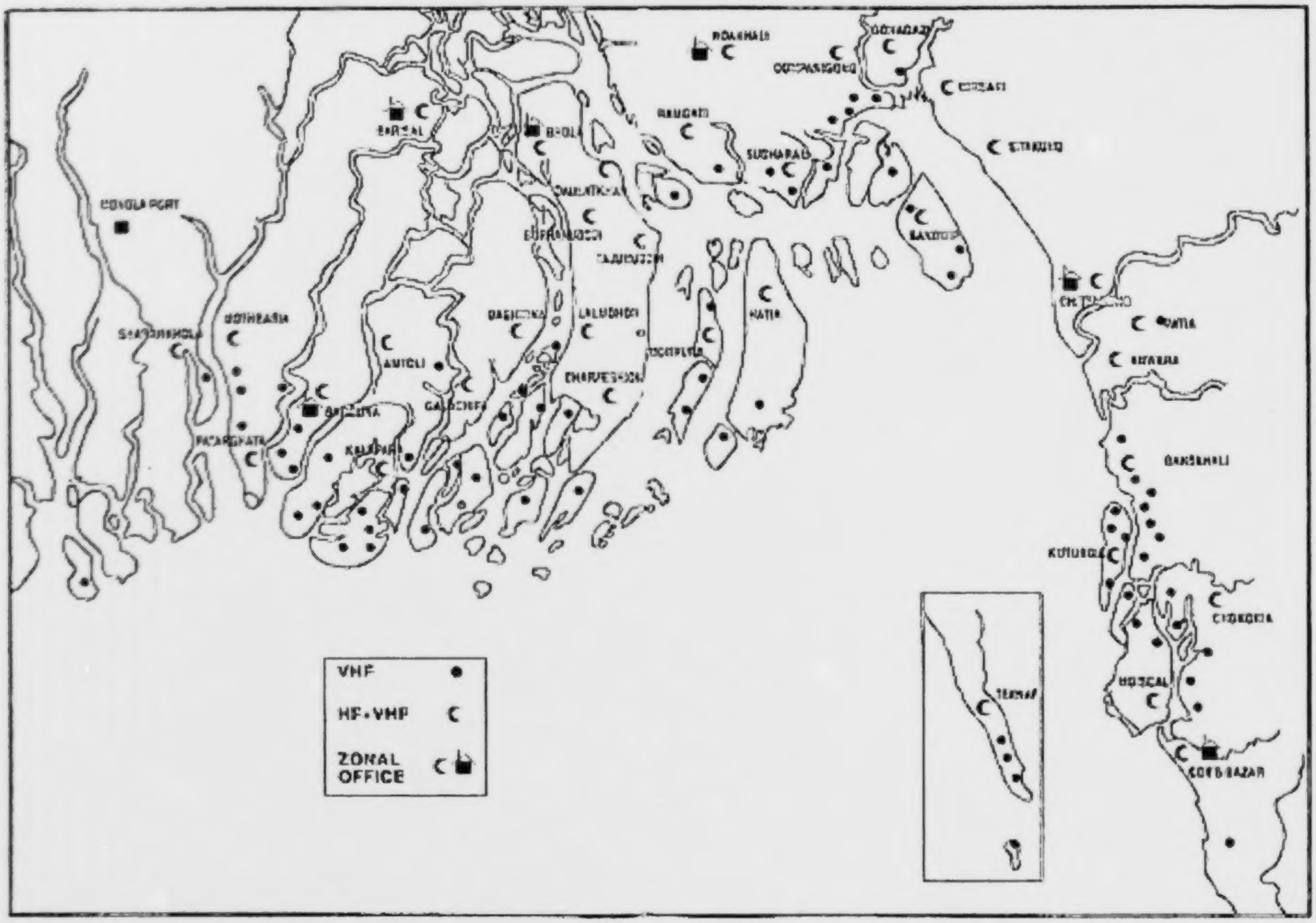
For better coordination between different Ministries and other stakeholders, the Emergency Operation Centre (EOC) is located at the Ministry of Disaster Management and Relief (MDMR). EOC is connected with all the District headquarters with HF Radio Links. There is one such link with Disaster Management Bureau (DMB) as well.

In addition, DMB as well as EOC shall be connected with BTTB Telephone as well as a Cellular Telephone connection from a Private Operator.

Alternate telecommunication facilities (HF Radio connection, BTTB connection and Cellular Telephone connections from Private Operators) at EOC and at DMB shall ensure fully functional telecommunication links between EOC and District headquarters during emergencies.

Telecommunication Network of Cyclone Preparedness Programme in the Coastal Belt of Bangladesh

LOCATION OF HF AND VHF RAD!O STATIONS OF CPP



Humanitarian assistance is possible using any technology. In acute situations, a primitive, low-tech approach may even be more effective than high-tech one. This has been amply demonstrated when all the sophisticated technology of Satellite Communication, Micro-wave Terrestrial Radio communications failed, with the breakdown of only one MW Radio Tower at Chittagong, in 1991. At that time the only communication worked in the Cyclone devastated area was the good old HF Radio systems.

True, Bangladesh does not have a sophisticated early warning communication system for the people living for survival in the risky coastal areas of Bay of Bengal. However, Bangladesh has been able to construct thousands of Cyclone Shelters in the coastal areas. And Red Crescent Society has a network of HF Radio communication system there. Once the danger signal of the weather forecast is received there in these Radio Sets, the volunteers of the Red Crescent Society; some 35000 thousands; distributed all over the coastal areas; physically propagates the danger signal in the affected areas and help the people in danger to take shelter,

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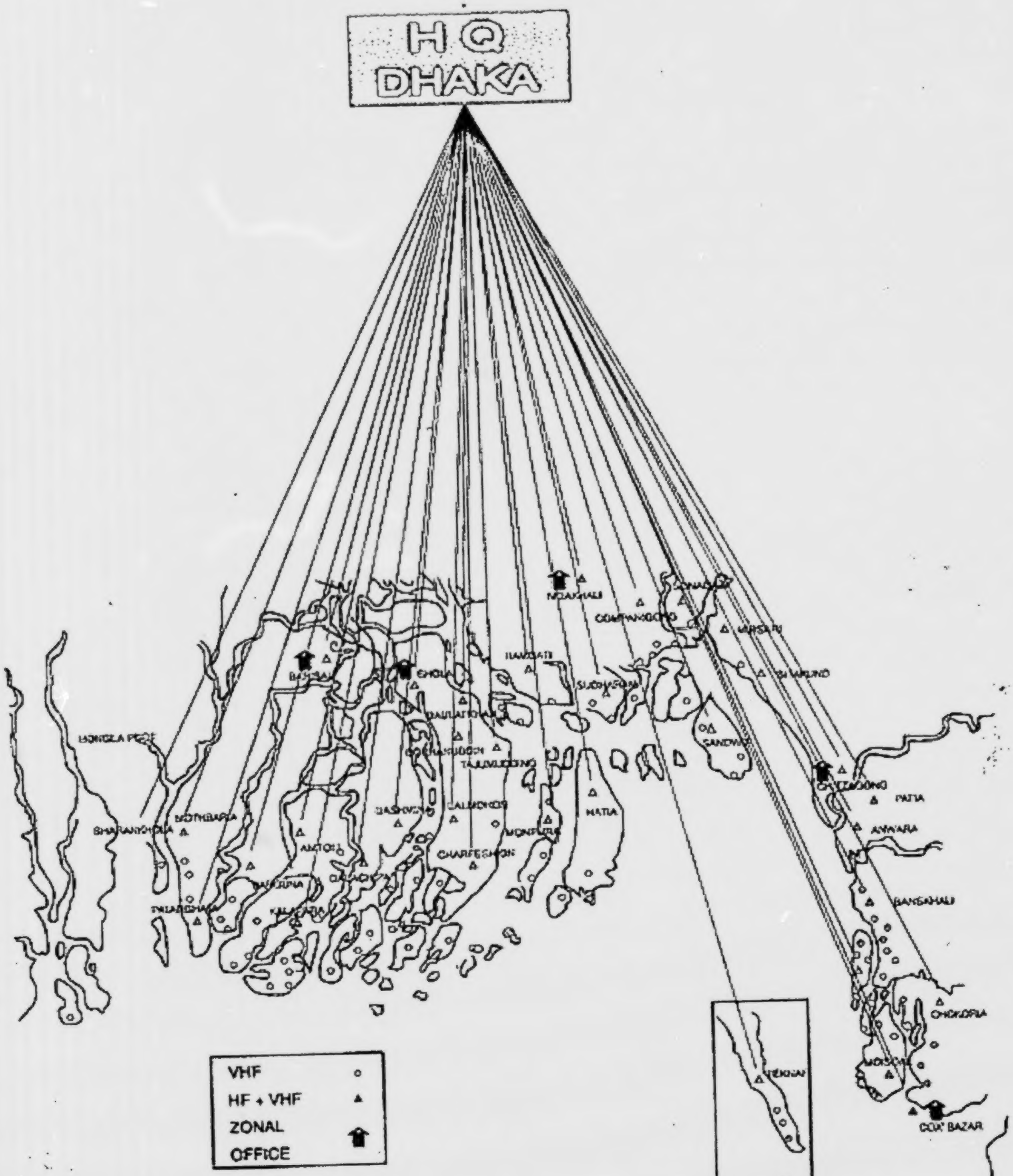
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Telecommunication Network of Red Crescent Society

The Vision

The cyclone shelters constructed are becoming part of basic infrastructure in most disaster prone areas. These shelters are the focal areas where people in distress take refuge. Innovative **Public Telephone Call Offices** (Kiosk) are planned there. These will be part of the future Cyber Kiosks with Internet connections, in the rural Bangladesh.

Some Cyclone Shelters are being used as schools. **Tele-education** can bring live classes of schools in cities to the schools located at these cyclone shelters. Bangladesh is considering introduction of Tele-education there.

Hardly any Doctors are available in rural areas of Bangladesh where 80% of population live. No Doctors or medical facilities are normally available in coastal areas. Community clinics are being established all over Rural Bangladesh; one clinic for 6000 population. Introduction of **Tele-Medicine** is being considered for making available medical services to patient living in these areas.

Geographical Information system (GIS) & Satellite Remote Sensing (RS) Technologies are used for Flood warning in Bangladesh. Satellite Remote Sensing Technology is planned for Disaster mitigation in the coastal areas as well. On line audio visual telecommunication facility shall immensely improve disaster mitigation in future.

Eternal vigilance with Emergency Telecommunications is the price Bangladesh is ready to pay for disaster management.

Endnotes

[1] World Disasters Report 1999, p. 52

[2] Statement of Ms Carolyn McAskie, Emergency Relief Coordinator; see the Summary Record and Conclusions of the First Meeting of Inter-Agency Task Force for Disaster Reduction, Geneva, 27-28 April 2000

Back to top of page   Back to the sessions page

Fazlur Rahman

Fazlur Rahman was born on 1st March 1937. After obtaining Degree in Electrical Engineering from Dhaka University (1958) with First Class, he joined the Electricity Department of the erstwhile Government of East Pakistan. From 1960 to 1971 he worked with the Pakistan Telegraph & Telephone Department in different capacities. Since 1971, he worked with Bangladesh Telegraph and Telephone Department / Board and in February 1995 he retired as the Chairman, Bangladesh Telephone & Telegraph Board (National Telecommunication Operator).

Fazlur Rahman was the architect for setting up of the Telecommunication Manufacturing Industries (Telecommunication Equipment and Cables) in Bangladesh. He pioneered easier access of telecommunication in rural Bangladesh. He worked in the Emirates Telecommunication Corporation, Abu Dhabi, UAE, on deputation as Chief Engineer for 1982 to 1987. Fazlur Rahman had been actively involved in International Telecommunication Union and Asia Pacific Telecommunity affairs on behalf of his country.

He is working as Chairman, South Asia Multi Media, (Independent Telecommunication Consultant of Bangladesh) and worked with organizations like The World Bank, International Telecommunication Union (ITU), Grameen Bank (Bangladesh), Andersen Management International A/S (Denmark), DETECON (Germany), TM [Telecom Malaysia] International Bangladesh (TMIB) etc. He is also working as Coordinator of the Association of all Cellular Operators in Bangladesh.

Fazlur Rahman speaks Bangla, Hindi, Urdu and in English. He is married to Shamim Rahman and has two sons and a daughter.

Back to proceeding page **Back to the sessions page**

Stimulating the Growth of Internet for Accelerating Development in South Asian Countries

N. K. Chhibber

Abstract

1. Introduction

South-Asian countries are developing countries and population density in these countries is one of the highest in the world. It is almost 100 years of deployment of telephony services in these countries and yet a majority of the population does not have access to the basic telephony services. Telecommunication is one of the most important strategic components to provide infrastructure to support economic development, social advancement and educational opportunities. Internet is the new word, which is synonymous with telecommunication, as it enables a common man to have a vast wealth of information at very low cost. The Internet has developed into the next most important communication medium, since the invention of printing press. Access to Internet is mainly through telephony network but in developing countries of South-Asia, telephone penetration is one of the lowest. Internet through cable TV is yet to be exploited commercially in these countries.

It is an accepted fact today that it is the Internet that shows the greatest potential of becoming a truly global public network. But before it becomes a reality, there are several technological challenges and issues to be resolved. It is not enough to have Internet access only. The reliability of Internet set up, affordability, security and ability of the people to use it are equally important factors, before it really becomes a global public network. In India, which forms over two-third of the market in South-Asia, the data and multimedia information infrastructure policy has been liberalized.

E-commerce was existent in developed countries before Internet, on private data networks built over public data networks, where as in developing countries it is a new mode of business. E-commerce today is mostly on Internet because of the cost considerations and convenience. VoIP is another change that is bound to come despite regulatory opposition and replace some of the traditional telecommunications, even though voice will remain the dominant mode of effective real-time communications.

2. The Internet Coverage Scene

The present number of internet connections in India, Pakistan, Bangladesh, Sri Lanka, Nepal, the main countries of South-Asia, is about 2.4 million, but these are mainly confined to metros and big cities. Approximately 50 percent of one million personal computer households have Internet access. Similarly there are 40 million households having cable TV connections and sizable households out of these are potential Internet subscribers, if Internet service through cable TV is offered at competitive rates. Pilot projects for providing Internet through cable TV are going on in some of the metros to make it commercially available. The growth rate of Internet users including through Internet kiosks is expected over 70 percent per year, during the next 5 years.

Two-third of the South-Asian market is in India, which is the second largest populated country in the world, with a population of one billion. It would, therefore, be indicative if Internet status in India is discussed in detail, as in other countries in the region; the situation is more or less similar.

Internet in India started in 1995, by VSNL the Government controlled monopoly ISP. The Internet policy announced by the Government in November 1998, allowing private players to provide Internet services was unusually liberal as mentioned below:

- It allowed unlimited number of companies to enter as Internet Service providers.
- Internet Service Providers are not required to pay license fee, but only bank guarantee.
- They could set their own tariff.
- Allowed setting up their own international gateways.

In just about three years after the policy announcement allowing private operators to provide Internet services, the number of dial up Internet subscribers has touched 1.8 million. In addition, there are about 1500 leased lines for Internet. The number of Internet users is estimated to be around 10 million, covering only 200 cities. This means, currently only one percent of Indians use Internet and e-commerce transactions were only worth US $ 105 million in 1999-2000. According to International Data Corporation forecast, the Internet connections in India would increase over 7.5 million connections by the year 2003. The Internet subscriber growth is expected to be influenced, by factors like reduction in Internet usage tariff, fall in computer prices and Internet access through cable.

The Government of India has issued licenses to over 225 companies for all three types of licenses; Category A for all India operations, Category B for metro and state level licenses and Category C for medium and small cities. Bandwidth availability is no longer a problem with the commissioning of FLAG Undersea Cable Network. A few gateways by private operators have already come up and some more are coming up.

About 75 licensees have already started offering services in different regions and different cities. But penetration of Internet in small cities and towns is very low with almost non- existent in sub-urban and in rural areas.

3. Existing Services and Problems

One of the biggest problems in developing countries is the poor service culture. Even after introduction of competition and privatization, the improvement is marginal. Any number of complaints to consumer services desks of the companies or even to consumer courts/forums yields no results. A large number of consumers cut down the usage of Internet to the barest minimum to avoid the nuisance of poor service and use it only when it is absolutely essential. Poor quality of telephony network, particularly the access network is another cause of frequent disconnection and low data rate, resulting in increase in telephone bill.

Large numbers of PCs are locally assembled and use pirated software. Even for branded PCs, servicing facilities are available only in metros and big cities. This results in frequent hardware and software problems causing long down time of the facility. Usage of Internet by most of the home users is mainly for e-mail. This creates the problem of virus, as most of the anti- virus software packages available are not very effective. Frequent power supply interruptions is another problem in most parts of the developing countries. Total cost of having an Internet facility further goes up, as battery backed un-interrupted power supply (UPS) unit, costing around US $ 150, becomes essential.

Internet nodes have been set up only in district headquarters. Internet accesses during usage from small towns and sub urban area are, therefore, treated as long distance trunk calls between the user locations and the district headquarter nodes. This is mainly because Internet services in such areas have not so far been extended by private competing ISPs. Once competition builds up, all connectivity is expected to be offered as local connection.

4. Internet Creates Information Culture

The government, individuals and various other organizations in developing countries have understood Internet's strategic importance. Internet is the new paradigm of information culture. The government of these countries have realized that how convenient and corruption free it would become by using Internet as the communication media for providing services to the population. There are two kinds of sources for governmental information on the web:

a. Sites containing information about government, run by non-government entities.

b. Government run sites.

People living in remote areas or in small towns/villages, can get information and application forms for services like driving license, income tax payment, passport services, ration cards, from the nearest Internet Kiosk by paying very nominal charges.

The main services in government sector include the following:

- Directory of government departments.
- Legal documents and forms.
- Tax information, passport and driving license.
- E-mail facility to communicate with concerned government officials.
- Examination results and election results.
- Railway bookings.

Various societal services on the Internet are as given below:

- General and business news.
- Health services.
- Education, university admission, scholar ships.
- Travel
- Banking, investment, stocks.
- Employment

In India, out of 607,000 villages, 290,000 villages still do not have even basic telephony services. National Telecom Policy 99 envisages provision of low speed data service to these 290,000 uncovered villages by the year 2002 under Universal Service Obligation. Village Public Telephones in these villages would actually be Public Tele-info Centers (PTIC) having Internet capability. The existing 317,000 Village Public Telephones would be upgraded to PTIC status by 2002.

Popularization of Internet Kiosks or Dhaba even in urban and sub urban area will improve access to Internet for those who cannot own computer or do not have Internet access. As only 5 percent of the people can interact in

English, it is essential that services model available on Internet must be designed for local languages.

5. Electronic-Commerce and Internet

There is a big hype about e-commerce and it has captured the imagination of urban people at large and businesses in particular. People are being bombarded with new e-commerce buzzword everyday. Print media is full of write up on e-commerce and advertisements about training courses on e-commerce. At the same time it is creating a lot of confusion with general public as consumers and even with medium and small businesses. Availability of essential technologies like authentication of credit cards, database of products are yet to come in a big way, though web designing has caught on well.

In developing countries, following requirements are yet to be met before e-commerce becomes popular and its benefits reach the middle class as well:

a. A reliable telecommunication infrastructure.
b. Effective Cyber laws. In India IT Act has been passed, but its effectiveness is yet to be seen.
c. High PC penetration. At present PC penetration is very low, but cable TV penetration is around 40 million households and about 50 percent of these can be potential users of e-commerce.
d. Availability and usage of plastic money. Except for a few multinational banks, which have branches only in metros / big cities, local banks have yet to set up their own data networks for financial transactions. However payments by conventional means can carry on along with the usage of plastic money.

Business-to-business (B2B) e-commerce is the business, already being transacted between big and medium sized companies and between a company and its supply chain, suppliers, resellers and vendors. Business-to-consumers (B2C) e-commerce which is electronic business between a company and individual customers is still in its early stage and is confined to big cities only and that too for some selected products/services. Even where every thing for e-commerce working is in place, people do not feel shopping on Internet safe. In India, the recent IT Act has given some teeth to law to enforce discipline in conducting business transactions, but how effective it will become is yet to be seen. Given the Internet's borderless nature, global jurisdictional framework for e-commerce is yet to be defined.

Bulk of the business and commercial transactions in developing countries are done in local languages. The e-commerce model, therefore, must be designed for the local languages. Many on-line companies do not accept credit cards for fear of fraud. Consumers also avoid paying on-line, unless they are sure of product quality, delivery in time, no hidden costs and after sale service, where applicable. Thus, to encourage e-shopping one of the suggested models could be; shoppers select and order the items or services online after browsing, then pay by traditional way in cash on delivery. A nearby Internet kiosk can be used for browsing and placing an order, where people do not have their own Internet connection.

6. Changing Regulatory Environments

The concept of an independent regulator is comparatively new in developing countries, as privatization and competition itself are recent changes from government controlled services. Separate regulators have been created in almost all the countries of this region during the last five years only.

In India, the Telecom Regulatory Authority of India (TRAI), is functional since January 97, with a view to provide an effective regulatory framework and adequate safeguards to ensure fair competition and protection to consumer interests. TRAI has tried to adopt the pattern of Canada and a bit of Australia. But finally it has to evolve and mature with its own situations and experience.

Main functions of the Telecom Regulatory Authority of India, formed in March 1,1997, are to ensure:

- Tech compatibility and inter-relationship of service providers.
- Regulate revenue sharing.
- Compliance of license conditions.
- Facilitate competition and promote efficiency.
- Resolve disputes between service providers, and with consumers.
- Advise Government on development of telecom.
- Compliance with universal service obligations.

The Government of India has reconstituted TRAI in January 2000. The role of TRAI has been redefined by the TRAI Amendment Ordinance 2000, which defines the role of newly constituted Appellate Tribunal. The high lights of the new ordinance are as given below:

- Department of Telecommunications sets policy framework and issues licenses.
- Separate department as service providers.
- TRAI sets tariffs and advises on policy issues.
- Telecom Disputes Settlement and Appellate Tribunal.
- Its orders can be challenged only in Supreme Court.

The Government and the Regulator in India have been fairly liberal to bring and encourage competition by private Internet Service Providers. There is no license fee and an ISP is permitted to set its own tariff. International gateways and backbone network are also permitted to private operators as well as to infrastructure providers. However voice over Internet (VOIP) is not permitted, but is likely to be allowed along with deregulation of international long distance communication, which is being opened to private competition by April 2002. As growth of Internet is linked to the telecommunication access, regulatory environments for telecommunication growth are equally important.

The Government of India has recently allowed 100 percent foreign holding by global e-commerce majors. The Government is also considering raising the foreign holding limit in companies which provide Internet services from the present restriction of 49 percent to majority holding.

The draft Information, Communication and Entertainment (ICE) Bill 2000, envisages the setting up of an Information, Communication and Entertainment Authority of India (ICEAI) with sweeping powers, regarding issues related to licensing and regulation of ICE services. TRAI will be part of it. The draft bill empowers the proposed ICEAI to set the license fee for various ICE services, ensure compliance of conditions, and ban Indian sites and TV networks hosting objectionable contents and to manage the spectrum. The proposed Bill seeks to remove ban on Internet telephony.

7. Meeting the Growth Challenge

Internet economy cannot take off, unless people have access to information infrastructure for which a sound and reliable telecommunications network is essential. India has one of the largest telecom networks in the world with nearly 28 million telephone lines and the growth rate is 24 percent. But 80 percent of these lines are in urban area and about 40 percent of the population have no access to even basic telephony services. The Government has the target of increasing the Tele-density from the present 2.8 per hundred to7 by the year 2005 and 15 by 2010. Licenses for basic services to more private operators and for national long distance communication services are expected to be issued soon.

Bandwidth availability is not a serious problem at present but steps to increase the bandwidth to meet the future growth are required to be taken in time. The Government of India has set up a Bandwidth Advisory Committee comprising eminent personalities of the IT and telecom sectors to advise the Department of Telecommunications (DOT) on the steps to be taken to ensure availability of bandwidth on demand. Under the National Long Distance Communication service opened to private competition in August 2000, infrastructure providers will compete to provide assets such as dark fibers, right of way and end- to-end bandwidth to service providers. As regards bandwidth required for overseas connectivity, currently the total international bandwidth available in India through submarine cable of FLAG is 10 GB and an additional 20 GB from SEA-ME-WE-3 is also available.

Department of Telecommunication has opened Internet access nodes in all district headquarters and local charging areas. ISP licenses have been issued to about 200 applicants with no license fee. Department of Telecommunication is setting up a countrywide backbone infrastructure for making it available to the private Internet Service Providers. Licenses for building international gateways have been issued to private companies. Blanket approval has been given for Foreign Direct Investment up to 74 percent in satellite systems for telecommunications, broadcasting and Internet related services.

But all this is taking to nowhere as far as growth of Internet in sub urban and rural area is concerned. First and foremost goal has to be to explore all possible ways of achieving the increased access to telecommunication services. At the same time developmental work is to carry on to achieve commercial viability of Internet through cable TV.

A more innovative, constructive and progressive approach is needed keeping in mind the achievements and pitfalls gone through by the countries that have achieved faster growth results.

8. Conclusion

Internet has given new meaning to telecommunications. Together they have increasing influence and form an important sector of modern economy. Internet would open up a tremendous world of e-commerce, which can boost overall economy and create employment opportunities apart from improvement in government services, education and health. Internet and internet related services in developing countries can be further stimulated by encouraging competition, jointly enforcing effective cyber laws, following international standards, allowing internet telephony, design system for local languages and make bandwidth availability on demand at reasonable rates through satellite or under-sea fiber optic cables. Finally the growth of internet depends on ability of Internet Service Providers to survive and compete in changing market place by providing solutions through internet applications so that people can have confidence in e-commerce. The new economy is a combination of lower costs, reduced initial stage profits and combining of businesses that allow free pricing by Internet business.

Presently, Internet connections in these countries are mainly confined to metros and big cities. Growth of Internet and emerging opportunities are amazing despite difficulties of resources. The growth rate of Internet users including through Internet kiosks is expected to increase exponentially. But balancing Internet penetration between rural and urban is very important to reduce the wide gap in the developing countries. Use of simpler new generation IP infrastructure and convergence of services that will revolutionize the way we communicate and do business is another step in this direction. However combined efforts and significant contributions by the governments of the countries, the industry and non- governmental organizations are needed to reduce the digital divide and develop digital unity by providing opportunities throughout the South-Asian Region.

Telecommunications itself that includes Internet, IT, broadcast is a multi billion dollar business and its growth is phenomenal. Vast opportunities for employment and small business are generated due to telecommunication services. As Internet access is made available in all parts of the countries, Internet traffic as a percentage of overall telecommunications will grow making communication less expensive and people's earning power increases.

Back to top of page **Back to the sessions page**

N.K.Chhibber

Mr. N.K.Chhibber is an engineering graduate and a former Air Commodore of Indian Air Force, where he worked for 32 years as Communications Engineer. His main experience has been in design and execution of high power radar and communication networks for the Air Defense. He has also worked in corporate sector after privatization of telecommunication sector in India. He has presented a number of papers on rural telecommunications development and disaster management in developing countries at international conferences.

Presently, he is President, Telescan Systems and Services. He has carried out a Case Study on Maharashtra Communication Network for Disaster Management in India for ITU-BDT, Focus Group7. The case study has been posted on ITU web site.

He is also Secretary General, PTC India Foundation.

Back to proceeding page **Back to the sessions page**

@ **Technology**

Wednesday, 17 January 2001
1030–1200

W.2.4 Networking Technologies
(Webcast, Sponsored by Compaq)

Location: Tapa II

Chair: YASUHIKO KAWASUMI, General Manager, Japan Telecom Co., Ltd, *Japan*

W.2.4.1 Carriers Network Infrastructure in the New Millennium (ABSTRACT)
(moved to W.2.6.1)

GIHYOUK LEE & WONHEE SULL, Platform R&D Center, SK Telecom, *Republic of Korea*

W.2.4.2 Voice Quality in Next Generation Networks (ABSTRACT)

TIMOTHY HULT, Senior Product Manager, Echo Products, Ditech Communications Corporation, *USA*

W.2.4.3 Advances in Optical Networking Technologies and Its Benefits to Service Providers and End Users (ABSTRACT)

WILLIAM R. ERICKSON, Senior Vice President, Planning, Fujitsu Network Communications, *Japan*; PAUL R. MORKEL, Director-Long Haul Photonic Products; and DONALD P. FREY, Principal Strategic Planner, Optical Networking Solutions, Fujitsu Network Communications, Inc., *USA*

W.2.4.4 A Framework for End-to-End Quality of Service (ABSTRACT)

JINGSHA HE, Member of Research Staff and TAKAFUMI CHUJO, Manager, Fujitsu Laboratories of America, Inc., *USA*

CARRIERS NETWORK INFRASTRUCTUREIN THE NEW MILLENNIUM

Gihyouk Lee and **Wonhee Sull**

Abstract

kevinlee@sktelecom.com, sull@sktelecom.com

I. Challenges that carriers face in the new millennium

The telecommunications industry now faces fiercer competition than ever in the converging network business environment. Carriers must provide cost-efficient and innovative services to consumers requiring carriers to modernize and bring the networks to high-speed so as to provide new services.

From the users' point of view, the Internet and data applications take up an important part of their business, education and daily lives. Data traffic volume is doubling each year in many countries and it will become the dominant traffic in the near future. In order to meet this market demand, therefore, carriers will need to not only provide new services, but to accumulate technology at a low cost [1].

Today's telecommunications network is categorized largely into TDM (Time Division Multiplexing) type of circuit switching network and packet switching network. While the circuit switching network provides services for voice services, the packet switching network supports data and multimedia services. These two types of networks have been built and operated separately (as illustrated in Figure 1), but some networks as in the case of SK Telecom have data and voice services possible on a tightly linked infrastructure.

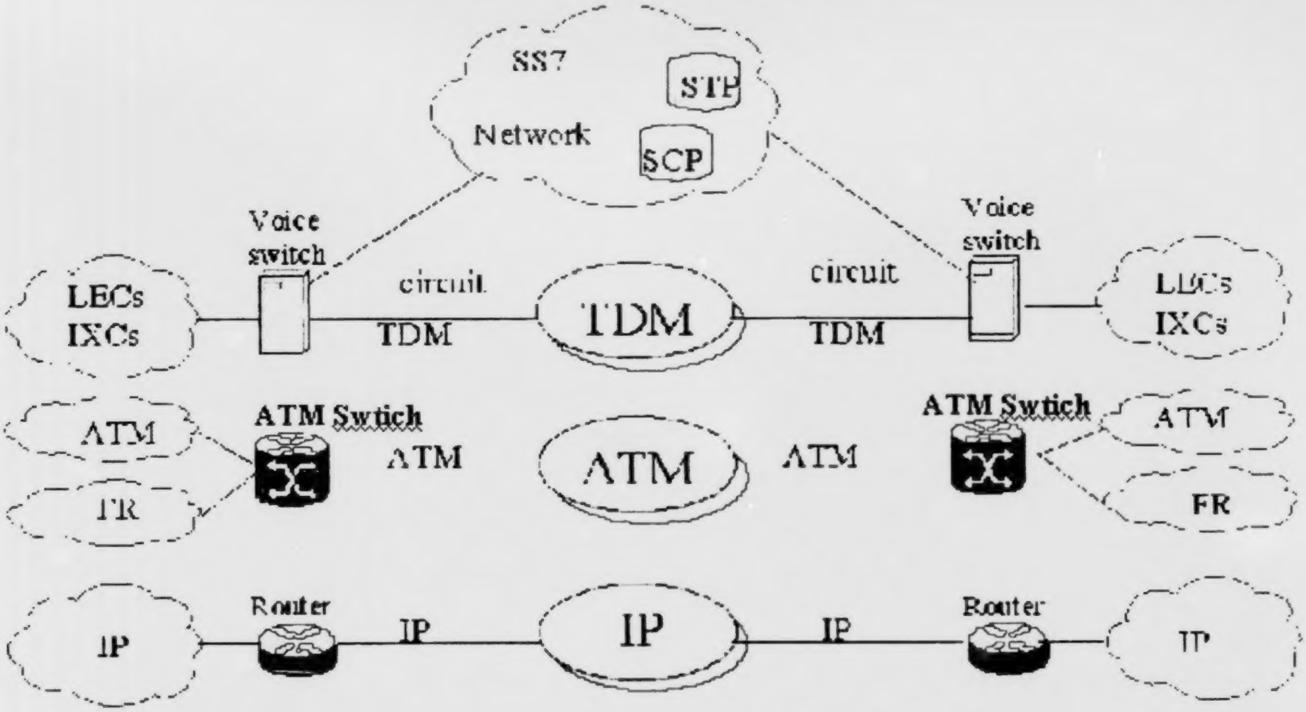

Figure 1. Existing Network Architecture

However, the Circuit Switching network has been very effective in providing abundant portfolio to provide high quality voice service, directly linked to profit generation. Because such network structure is not the technology most adequate to provide the new data and multimedia services, the packet switching network technology is required to effectively control the large volume of data transmitted through the network. For this reason, telecommunication industries must resolve several key problems [2] [3].

First of all, the voice service market will not disappear, but will keep growing. In developing the packet network based on a variety of service structures that are economical and effective for voice and data, decision has to be made between the direct migration of the TDM network into the packet network and the development of a single packet network designed from scratch.

Secondly, in Korea, in particular, current packet networks have been built for a various purposes: to support ISP(Internet Service Provider) business, the Frame Relay business or enterprise business operations. However, most of these networks are not to easily evolve to support extensive xDSL (ADSL, HDSL, SDSL, VDSL) service structure, ATM service, or the IP service. As a result, an upgraded and/or new data network needs to be developed to provide data services.

Finally, it is very costly to build an isolated network to be used for a specific task. Also, it is difficult for a network designed for a specific application to be used for a variety of integrated value-added services. Consequently, it is necessary to design an integrated network infrastructure for cost reduction and service integration.

II. A new integrated network with dispersed functions

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In this section, we proposed a new integrated network with the motivations identified in the previous section. The new network model consists of a high performance packet switched backbone that is accessed by a variety of edge or gateway devices as in Figure 2. These edge devices provide the interface between the customer and the network, supporting protocol conversion and efficient concentration of network bandwidth.

The gateway devices provide the links between the PSTN(Public Switched Telephone Network) and the new packet network, ensuring services transparency and ubiquity. The network is controlled by servers or call engines with built-in intelligent software technology such as call access request and service provisioning.

Multiple servers may be required to work together to deliver a specific service to a customer. The industry standards for the compatibility between the server and components of other networks are being developed to accommodate various equipments and international standardization organizations are making preparations accordingly.

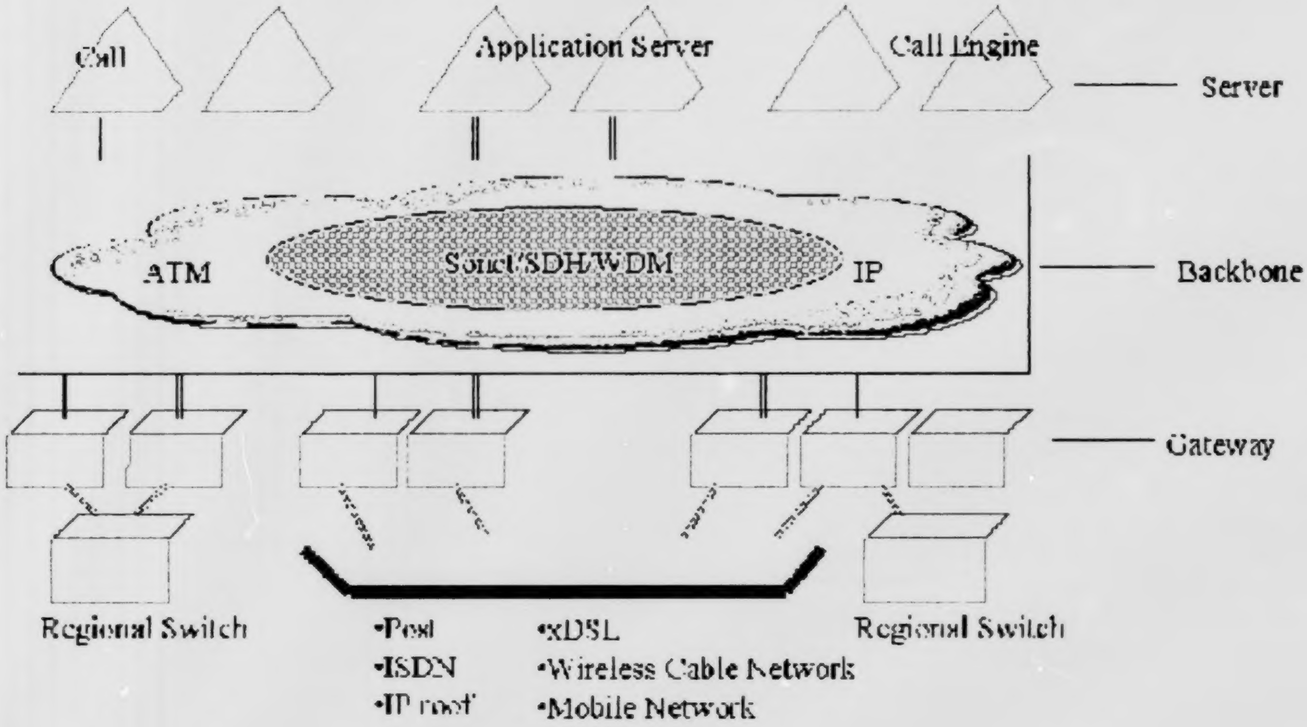


Figure 2. The Proposed Integrated Network Architecture.

Furthermore, efficiency is a key factor in the newly developed packet switching network. An industry standard is being developed based on the two basic packet technologies, ATM and IP.

ATM is a packet protocol which is already in use in numerous network and is applied to facilitate efficient voice and data service within one single network and it has the ability to provide high quality service. IP is a widely used protocol that supports most of the data within the network. Today, IP is still under development or only part of the service is available, but it will be able to provide hiqh quality service in the near future. Most telecommunications companies, therefore, use both technologies - ATM for the core network and IP for terminals [5] [7] [8].

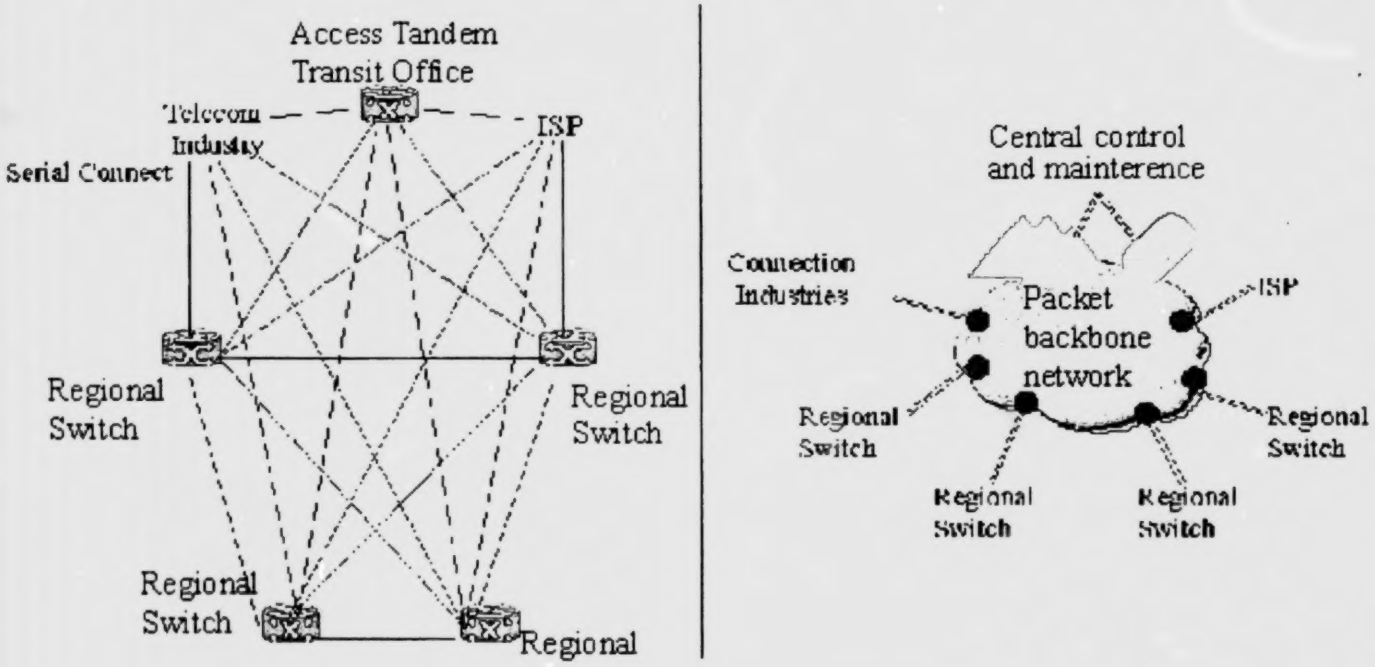
The most important characteristics of this new infrastructure is the dispersing of functions. In other words, service functions and applications functions can be divided through the packet switching network rather than centralizing the functions in a specific circuit switch. This allows better flexibility and optimization in designing the network and various positive benefits in terms of cost and service can be produced since network components can be located anywhere in the network.

II.1. Voice Solution for Telecommunications Companies

The new network of telecommunications companies, which helps solve today's voice and data call traffic issues, enables packet-based services. Such development of integrated network provides a foundation for building up competitive edge to service suppliers without network investment or service cost generation.

- The new network will replace the TDM-based voice network with the multi-service packet network without giving any ill side effect on the existing voice service. This solution will solve the Tandem Trunk exhaustion problem and replace the voice tandem (gateway) using the ATM core network [5].
- The tandem (gateway) connection is the first step to migrate from TDM voice trunk to ATM AAL2 for bandwidth accumulation of the core network which would have voice services available with VoATM or VoIP. It is a multi-service using ATM or IP core network [5] [7] [8].
- The way to connect IP is having telecommunications companies to build a new voice infrastructure in the IP network that has Off-The-Shelf call server structure. This solution provides voice and data service integrated in the IP structured network [7] [8].

The new network replaces the conventional node-based network with a packet-based dispersed network which is linked with the core network through a connection device. Figure 3 contrasts a typical today's voice network (a) and the target integrated network architecture (b).


Access Tandem
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Telecom Industry
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Central control
and mainterence
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Packet backbone network
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(a) A typical voice network **(b) The integrated network**

Figure 3. Transitions from today's multi-vender investments into the integrated Network architecture

II.2. Solution for the Shortage of Connection Lines

The efficient application of network bandwidth may be a solution to the shortage of connection lines as witnessed in the recent network access difficulty due to the increasing Internet call traffic and voice and wireless traffic.

A simplified network reduces the overall network maintenance cost a great deal and can provide better and more diversified services and expanded traffic capacity with a more dispersed and less number of network components in the wide bank packet network. This innovative design can reduce operation cost by integrating layers, eliminating connection points between layers and reducing connection operation. Also, service suppliers can change the investment from the current TDM core network to wide bank infrastructure data centralized while protecting the existing voice revenue source [16].

It is not necessary to modify the existing TDM equipment or redevelop software structure because the new network is distinguished from the new integrated packet network. The solution based on standardization has interoperability with all equipments of the supplier's ATM switching equipment. Therefore, the new network still supports today's useful services including call transaction pattern, data connecting and SS7(Signaling System 7) based services.

Also, a variety of services for new revenues is available. The multi-service network allows service suppliers to enter the market by building extensive service arena with various services in the network based on packet-based services.

Almost all equipment suppliers access the network using industry standard protocol which have interoperability with their TDM switching equipment, OSS(Operations Support Systems) system and ATM. Network components are required to follow industry standards of control organizations such as various network-related international forums, ITU (International Telecommunications Union), BELLCORE, ANSI (American National Standards Institute), and ETSI (European Telecommunications Standards Institute) [11] [12] [13].

The integrated network provides standard services to service suppliers using ATM/IP network with inherent QOS(Quality of service), low latency, and reliability benefits. This can ensure stability and quality required to provide sensitive services (99.999% efficiency, round-the-clock service).

The modular structure which allows cost efficiency and capacity enhancement maintains capacity variability and flexibility. It should be easily upgraded from small to large capacity.

II.3. Components for Constructing an Integrated Network

Today's TDM equipment continues to provide line-side telephone, enhancing return-on-investment for years to come and call servers provide important dispersing functionalities within the nodes such as call conversion which is linked to the integrated network and service logic [18].

The central controller provides conversion and relay control for the new network by eliminating the SVC (Switched Virtual Circuits) in the ATM network and constructing gateways. Call servers must be able to be composed of exchange offices which have Tandem/Transit office and software and processor upgrade.

Multi-service gateways (MGs) are linked to PSTN in connection with the regional relay network and to ATM network line. The termination point of this dispersion supports the connection with PSTN, TDM and ATM networks. The network connects with the ATM network using SVCs (Switched Virtual Circuit). The MGs should be independent intermediate gateway that can work and have interoperability with equipment suppliers' call servers using standard Media Gateway Control Protocol (MGCP).

The new network manager will be able to reduce network control cost by simplifying network control, operation and maintenance. Also, the new network manager will enter the market quickly with better quality of service, customer satisfaction and new services.

III. Development of the New Network

For service providers seeking solutions for Tandem shortage problem, new network solution should be developed for voice service first, then later, data network should be integrated within the multi-service network. As an alternative, multi-service and ATM switch used for data network can be developed at the terminal of network so as to collect voice traffic from MGs. Also, FR (Frame Relay), DSLAM (Digital Subscriber Line Access Multiplexer), IP and ATM will use the same network.

The new network solution is the optimal solution for using region- or nation-wide services due to its dispersed structure. In order to provide voice service in the packet network, CLEC (Competitive Local Exchange Carrier) and owners of facilities and equipment should make considerations for the switch equipment that allows integration with existing network solution.

III.1. Voice Gateway Solution

Among new switch equipment solutions, the packet network all server has a tandem locating functionality, which will replace the voice tandem layer. Switching equipments, on the other hand, should provide a unique gateway solution to transmit PSTN voice in packet core of ATM AAL2(ATM Adaptation Layer 2) or IP. Also, switch equipment should have interoperability with any call server of the equipment supplier based on standard protocol that is designed as official intermediate gateway [5] [8].

Due to the incomplete standardization of MGCP, switches should have a two-phase structure when constructing dispersed network structure. The first phase is the tandem connector solution and the second phase is the voice switch solution. The former has been successfully applied and is in operation in some telecommunications companies' networks and the latter is being tested by equipment suppliers.

III.2. Tandem Connect Solution

The voice gateway should be able to reduce the gap between T-1/T-3 trunk or leased tandem (doubles or triples the bandwidth margin which is supported by single DS 1 link) when an optimal ATM AAL-2 voice transport is applied to ATM (VTOA, Voice/Telephony over ATM).

A voice gateway solution is built to operate best in a multimedia ATM structure. It should be provided in the nodes such as Frame Relay (FR), IP, ATM and CLES(Company Local Exchange Carrier). Also, it is necessary to reinforce the transmission ability of ATM as well as voice transmission ability to PSTN network. CLEC which seeks expansion of voice service when voice exchange is not economical is becoming an attractive solution. Constructing a voice gateway within CLEC POP(Point of Presence) as a back up to the voice service in the central exchange site is one of many effective ways to rapidly expand CLEC service area [14] [16].

Tandem connect solution provides point to point connection in the packet network and the first phase is to support voice communication on packet. The next phase is linking with the call server using standards for supporting exchange voice services. Figures 4 illustrates the voice gateway used as PSTN voice transport.

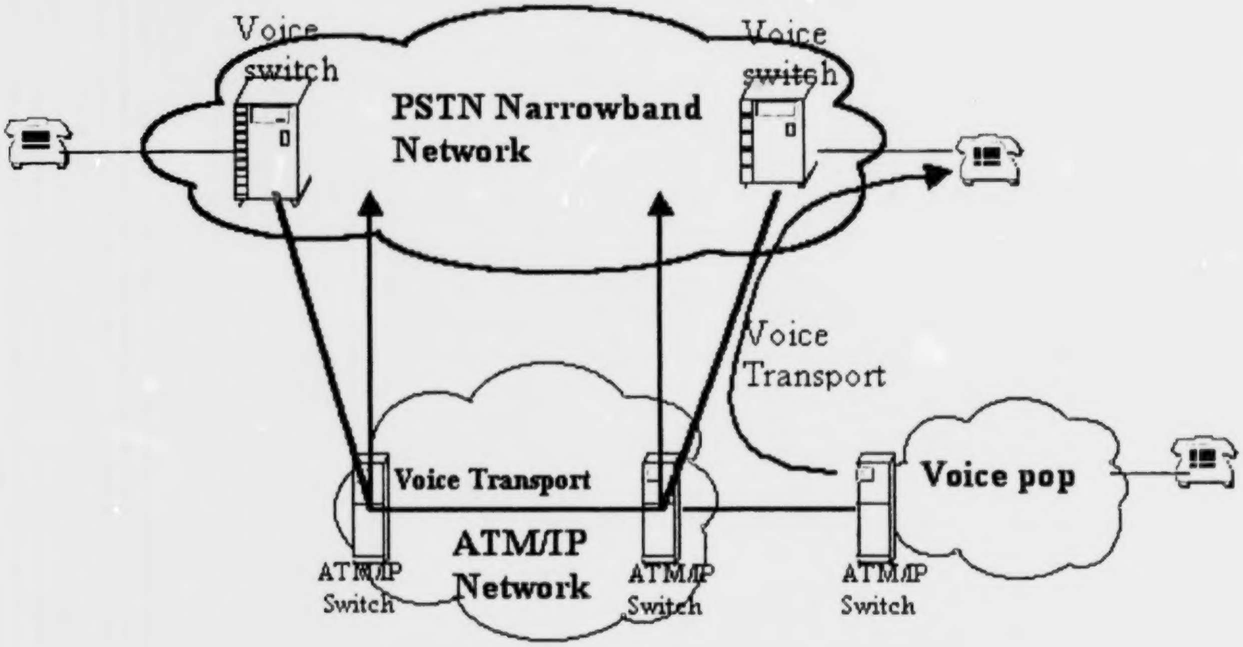

Figure 4. Voice Gateway used as PSTN voice transport

III.3. Switched Voice Solution

The switched voice solution provides continuity in packet system. A signal handling gateway connects the SS7 signal network using standard protocols such as IPS7 or ISUP+(ISDN user part) and then handles the MTP(Multi Transfer Processign) protocol by sending an ISUP+ message to intermediary gateways such as STP (Signaling Transfer Point).

A call server/intermediary gateway controller completes SS7 signal handling, supports the continuity in the core packet network using MGCP and performs exchanges, conversion and account functions.

The intermediary gateway performs connection setup and disconnection functions within a network. In addition, it compresses voice, removes mute and echoed sound, handles RTP/UDP/IP(Routing Transfer protocol / User Data Protocol / Internet Protocol) and manages voice including ATM and IP functions.

A voice gateway that plays an intermediary role interlocks with IP connection engine which is controlled by SGCP(Simple Gateway Control Protocol) for IP services and voice exchanges. It should interlock with a succession call server in addition to MGCP once it is standardized [16].

The voice gateway is popular among wireless service providers because it can be used as a core network between sites. It allows wireless traffic to detour a service provider's long distance network and local PSTN in order to reduce costs, and UMTS(Unified Message Transfer System) capable of transmitting data controlled by AAL5 and voice controlled by AAL2 is easily applied to it.

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Figure 5 illustrates switched voice network solution.

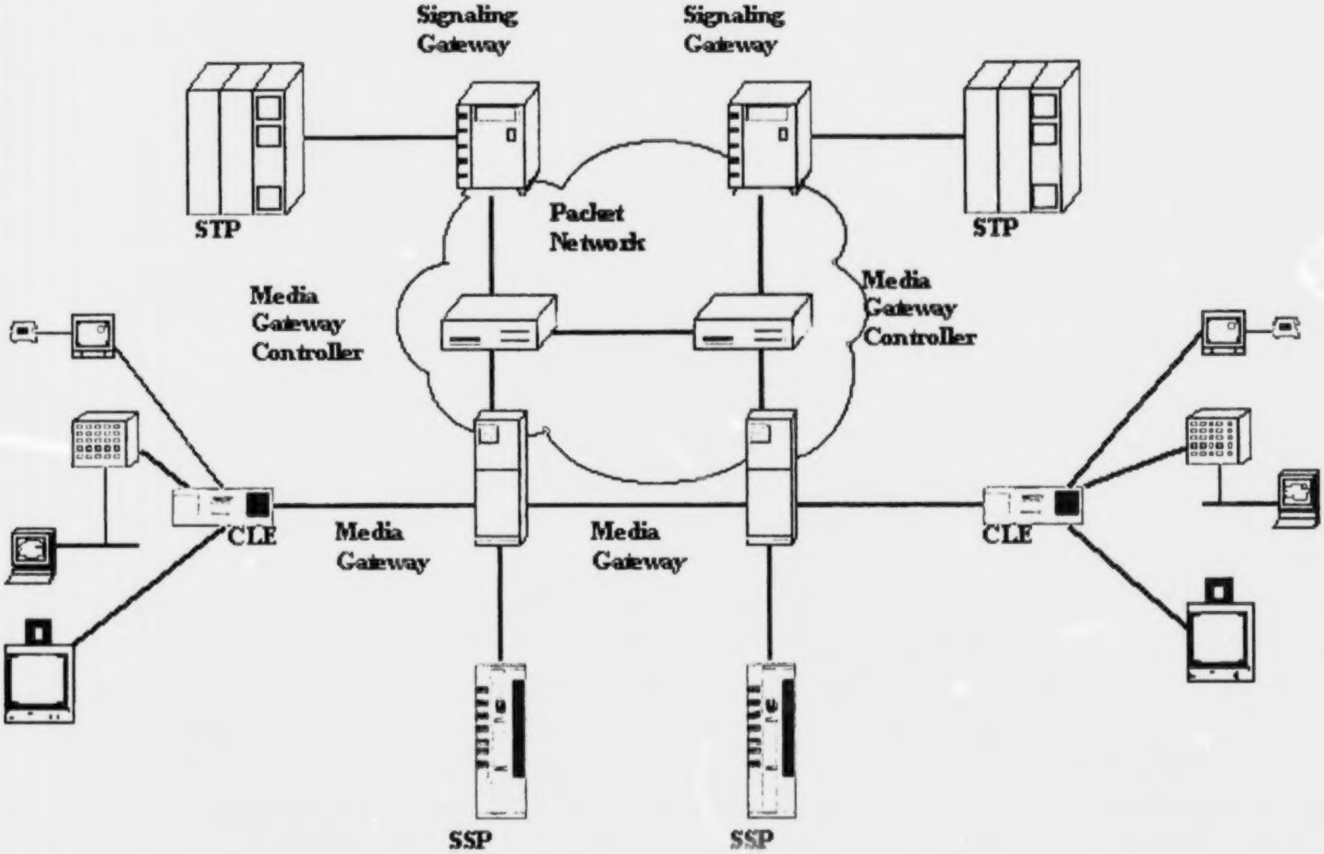

Figure 5. Switched Voice Network Solution

III.4. IP Connect Solution

All IP is often referred to as the next generation telecommunications network. This network is built with a large-scale Packet network as a basis and it is proposed as a solution provided that all existing networks are incorporated. Such Packet network provides a voice access functionality which uses the ISP (Internet Service Provider) based on the Internet Protocol and IP, a new area of the IP Telephony for voice telecommunications companies.

With IP connection to IP network capable of providing efficient, innovative and various services, telecommunications service providers can provide services for Voice over IP (VoIP) and Fax over IP(FOIP) which has reliability in data and voice in various forms [14] [15] [16].

IP connect solution has an advantage of composing a profitable tool for the IP business telephony in an indirect way. Also, the solution can provide a more advanced service such as call center application, call handling card, and interactive voice response in addition to improved call handling services such as call waiting and call transmission services.

Furthermore, telecommunications companies will be able to provide higher quality of application services such as global Centrex, unified message processing, global roaming and multimedia conference system which are

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not available in the PSTN and which are unique to IP network.

IP Connect is an end-to-end solution that must include call control, high quality application server, gateway between PSTN and SS7 network, customer accommodating equipment and it must be incorporated with various protocol connection strategies.

Figure 6 as seen below is a component of the new network of telecommunications companies. The new network is composed based on the Packet network. It incorporates the existing voice communications network, data communications network, and mobile phone related networks. The figure illustrates a summary of the telecommunications infrastructure needed by next generation telecommunications companies.

Special attention was given to the link among the following three components: IP Connect call engine needed for linking the voice communications network, the IP-SS7 Gateway to control the call engine and the 3 G (3 Generation) needed for providing high speed data service on the move.

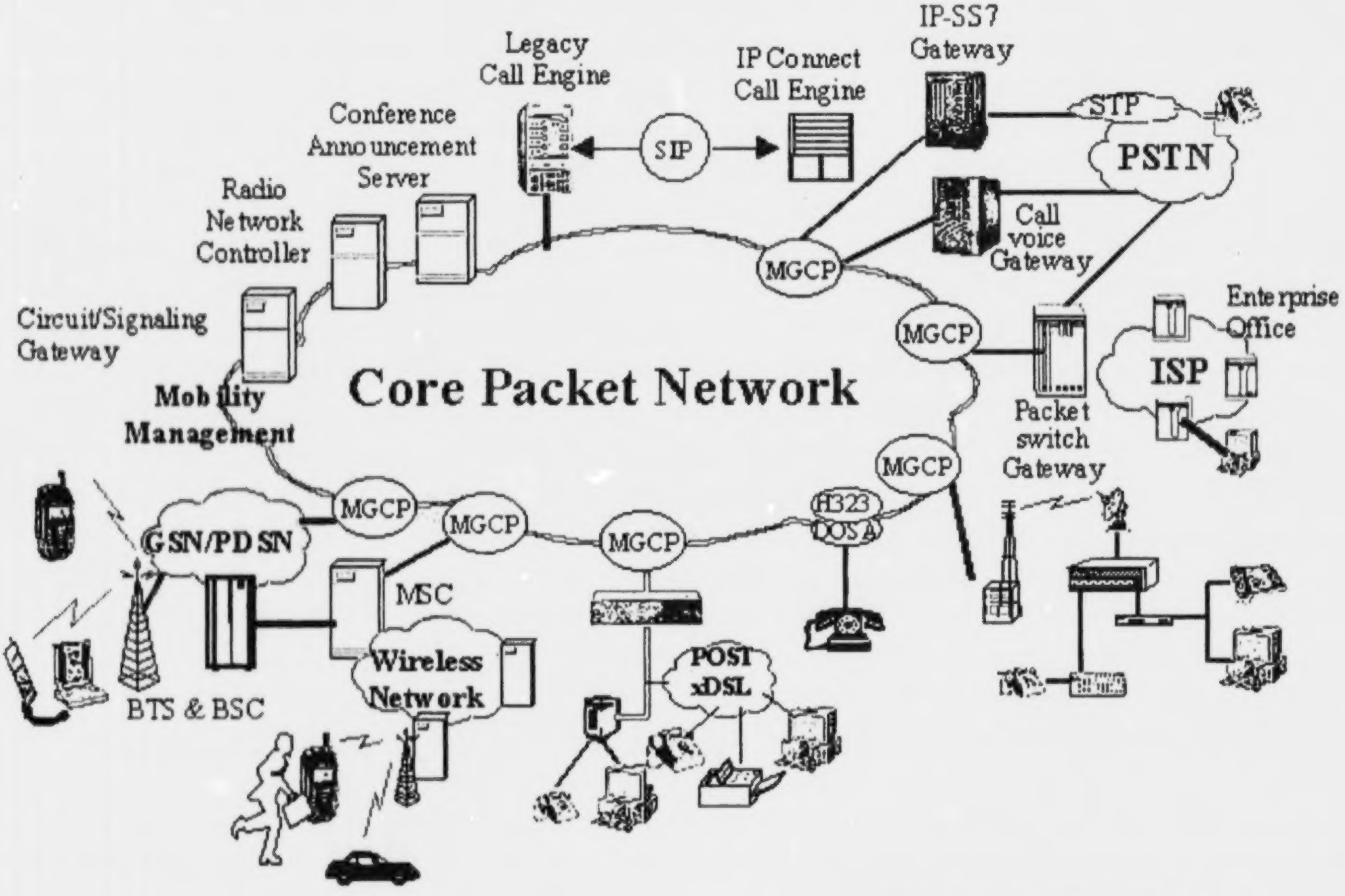
IP-SS7 Gateway
Legacy Call Engine
IP Connect Call Engine
Conference Announcement Server
SIP
STP
PSTN
Radio Network Controller
Call voice Gateway
MGCP
Circuit/Signaling Gateway
MGCP
Enterprise Office
ISP
Core Packet Network
Mobility Management
Packet switch Gateway
MGCP
GSN/PDSN
MGCP
MGCP
MGCP
H323 OOSA
MSC
Wireless Network
POST xDSL
BTS & BSC

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Figure 6. The New Network Connect Overview

The media gateway equipment plays the bridging role between different network types. The voice gateway is an ideal multi-service connection exchange device used for high quality, large scale IP based long distance network. This device has interoperability in a network with different gateway methods.

The media gateway call control equipment is an important device required for the IP connect solution. This equipment provides the call handling capability required to complete a variety of call types going through the IP network such as first step dialing, N00 call, PIN certified multiple step call and operator supported calls.

The IP Connect signaling gateway(IPCSG) provides secure and reliable access points to the SS7 network. IPCSG is the termination point of the MTP(Message Transfer Part) layer and links route ISUP(ISDN user part) to the appropriate Media Gateway. It may be augmented with capabilities in the future to provide geographic switch over capability not available with typical PSTN installations [17] [18] [19].

I. Conclusion

Service providers nowadays must be able to maintain the existing voice revenue sources while building or upgrading their infrastructure to develop new services. At the same time, they should be able to fulfill various demands from customers.

To achieve this, service providers must first enable the migration from today's rich PSTN voice infrastructure to multi-service packet networks. During this migration, it will be possible to construct multi-service access service such as xDSL by utilizing the multi-service packet infrastructure at the edge.

The new integrated network must be built to provide voice and multi-service functionalities using the multi-service packet infrastructure. The WAN switch gateway widely used today by service providers is used to accumulate bandwidth for the remaining infrastructure network facilities by controlling ATM AAL2 or providing voice relay using IP.

The voice gateway structure will carry out voice exchange functions in the dispersed network at a later time or it can be developed as an intermediate gateway that is linked to the intermediate gateway controller supporting MGCP standards.

The IP connect solution enables service providers to deliver voice services to customers using the existing TDM equipment. This solution focuses on delivering integrated voice and data services while supporting legacy service through this link. This solution is an adequate solution for carriers in building new IP focused network while providing voice services.

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Back to top of page **Back to the sessions page**

Voice Quality in Next Generation Networks

Timothy Hult

Abstract

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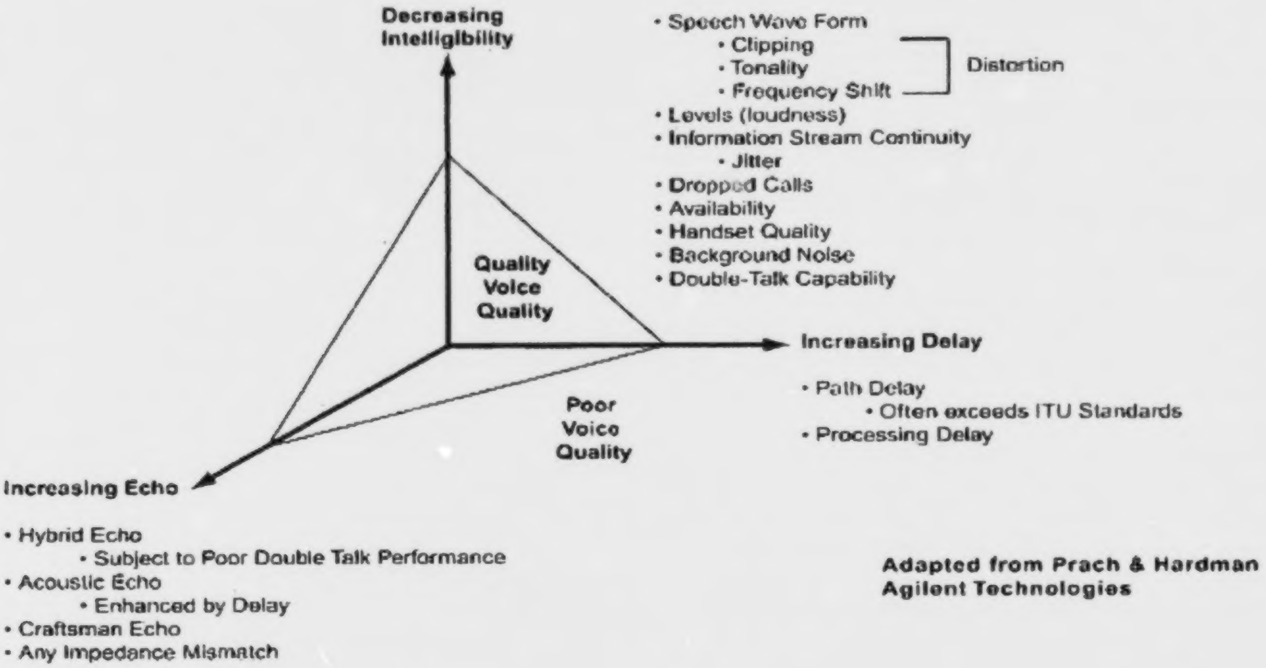
Defining Voice Quality: To establish a foundation for our discussion, it is useful to briefly review and acknowledge the body of standards available in the Voice Quality arena. Engineers prefer quantitative, objective measures of voice quality, and multiple standards exist to provide these: ITU-T P861, BT-CCI, and PAMS[1, 4]. Unfortunately, most of these methods require insertion of an intrusive tone and use of cumbersome testing equipment - a technique less than real-world friendly. Many therefore find subjective measures made over in-use lines to be more informative of real world conditions and for this, the ITU has established ITU-T P800 MOS (Mean Opinion Score) or "golden ear" test with scores ranging from 0 (worst) to 5 (best) - toll quality is generally considered to be 3.5 or higher. Informed sources will usually cite one or more of these standards as reference.


Decreasing Intelligibility
• Speech Wave Form
• Clipping
• Tonality
• Frequency Shift
Distortion
• Levels (loudness)
• Information Stream Continuity
• Jitter
• Dropped Calls
• Availability
• Handset Quality
• Background Noise
• Double-Talk Capability
Quality Voice Quality
Increasing Delay
• Path Delay
• Often exceeds ITU Standards
• Processing Delay
Poor Voice Quality
Increasing Echo
• Hybrid Echo
• Subject to Poor Double Talk Performance
• Acoustic Echo
• Enhanced by Delay
• Craftsman Echo
• Any Impedance Mismatch

Adapted from Prach & Hardman
Agilent Technologies

Figure 1: The Voice Quality Space [4]

Unfortunately, none of these standards really convey the multiple dimensions required for a detailed analysis of the total Voice Quality space. For this, it is useful to arrange the various Voice Quality factors into groups and the groups into a graphical representation. Hence, we define a three-dimensional voice quality space bounded by echo, delay and intelligibility axis. Each of these axis share a complex inter-relationship with one another, resulting in trade offs whereby improvements in one help the other and degradations in one degrade the other. An examination in turn of each of these axis will establish a foundation for solution and topology discussions later.

The Effect of Delay: The echo and delay axis are directly linked as seen in figure two. Low echo energy as measured by high Echo Return Loss (ERL) values (say -25dB) in a short haul circuit are not noticeable by itself, but when the circuit becomes longer and the consequent round trip delay is becomes higher the result is unacceptable voice quality. Similarly, short delays and high echo ERL's (-5dB) will also produce poor quality transmissions. Ideally then it is necessary to control both factors, but as we will see, today's emerging networks present a significant delay challenge in the form of ever-longer transmission lengths and processing times. Hence, a network designer must over-design for the smallest echo problem.

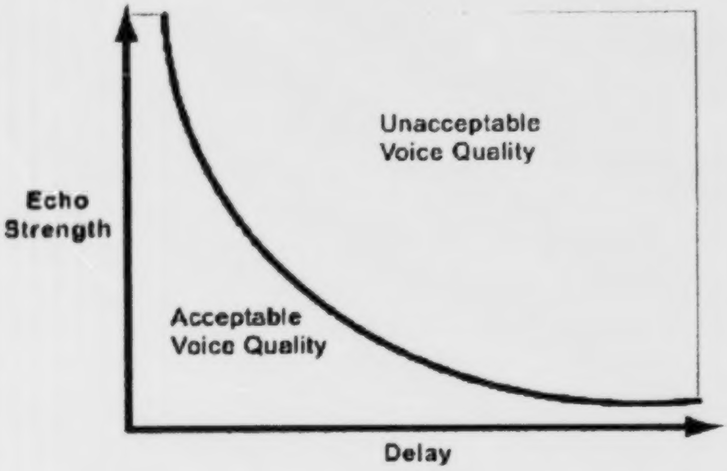


Figure 2: Echo Strength vs. Delay

Any echo generator is made noticeably worse when either propagation or processing delays push delays higher. Research conducted by The Bell System years ago demonstrated that a *total* delay beyond 50 ms noticeably reduced call quality and delays beyond 250 ms impair normal conversation. Indeed, one method AT&T used to achieve their legendary voice quality was by inserting an echo canceller on every long distance circuit, no matter how short2.

Figure 2 illustrates the complex interaction of delay and echo return loss on call quality. Strictly speaking, a strong echo return loss does not decrease call quality if the delay is short (this is the principal reason local wire-line calls do not require echo cancellers - the tail circuit is typically 10 - 30ms), and long delays with minor echoes also do not effect call quality, but do impact the pacing of the conversation.

One thing is certain about next generation networks, as they rush to offer more services; more processing will be required, generating more delay, resulting in poorer quality service. This is particularly true of converged networks where voice runs over packet protocols, and data is carried over wireless voice channels. The tables presented in figure 6 provide a short synopsis of both propagation and processing delays for wireless, Voice over Packet (VoP), and traditional wireline services. The values provided are a snap shot in time and while physics dictates propagation times, improved technology will (hopefully) decrease latency problems. For the present however, the network designer must be cognizant that the *total* user-to-user delay times are increasing, and that is a problem.

Knowledge of the total round trip delay is important. The ITU specifies the "maximum" delay across both the US and across the Atlantic at 50ms each. What is not stated is this value is a goal, not an enforceable fact, and few, if any but the most end-to-end dedicated carriers are capable of achieving it. Unfortunately, the existence of this specification has spawned a disturbing trend in the equipment manufacturing community that delay and echo are problems of the past for digital networks. The result of this naïveté, are equipment designs not sufficiently robust enough to accommodate actual conditions in anything but the most ideal circumstances. In today's deregulated telecommunications of a competitive patchwork of networks, a single telephony call may traverse 4 carrier's networks transported on TDM converted to VoIP transported over ATM on a SONET backbone - no one is responsible for the *total* delay, and hence it routinely exceeds 50ms - 70 to 90ms is common for trans-N. American packet based backbone VPN telephony. For example, a single non-optimized VoP gateway *may* consume the entire 50ms delay budget in one location through compression, packetization, and buffering (reference figure 6).

For instance, wireless operators using packet backbones are experiencing tail delays at the extreme range of traditional

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echo cancellers2. In these cases, back-to-back echo cancellers may be employed. That is, one echo canceller is pointed toward the tail end of the circuit (the wireless end user) the other pointed toward the network to cancel echo generated by an impedance mismatch in the TDM to VoP transition. It must be pointed out that echo cancellers do a poor job of canceling echo over a packetized, or compressed network due to quantization errors induced in the coding / decoding process, but are effective when pointed in these directions if the echo source is beyond or outside the packetization regime and the echo canceller is outside these areas. A good example of this would be a long-haul international circuit with compression occurring over the long haul circuit and the gateways at either end feeding local PSTN loops. In this example, the impedance mismatch occurs in the PSTN network and a special "long tail" echo canceller is required.

The Effect of Echo: Classically, there are three sources of echo, and at least one is present in every voice call: network or hybrid echo, handset acoustic coupling (poor earpiece to microphone isolation), or ambient acoustic echo (acoustic feedback). For next generation networks, we must add the notion that *any* impedance mis-match occurring anywhere in the transmission path will generate unwanted echo in a manner similar to similar to traditional hybrid echo. Hence, the *opportunity* for echo is present in most networks. As a rule of thumb, any echo in the presence of a delay greater than 50ms will require an echo canceller in the circuit to ensure toll quality service.

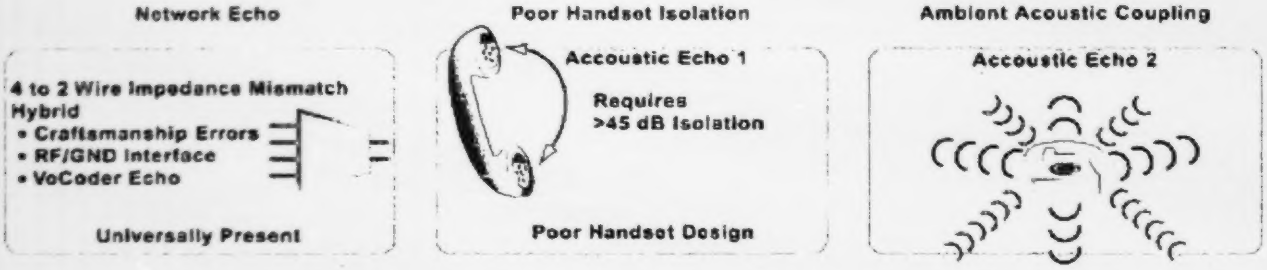

Figure 3: Three Sources of Echo

Network Echo: Network echo is the modern name for what has traditionally been called "hybrid echo," but in the emerging world of all digital next generation networks, this term no longer strictly applies and using the term network echo is more appropriate. Network echo is generated by any impedance mismatch within a network element. Traditionally, this was at the four wire to two wire Hybrid located in the tail end of the PSTN circuit - the analog to digital conversion point. Next generation networks often do not have hybrids, but network echo is indeed present all the same as other elements may present impedance mis-matches which cause a reflection to occur back down the "line" to the originating speaker. While the strength of these reflections may be small, we have already seen that small reflections multiplied by long delays equals echo problems. Examples of these mismatches are vocoder reflections; craftsmanship errors - using the wrong connectors or cable sizes are common; Air / ground interfaces in wireless networks. Voice Enhancers / echo cancellers traditionally have acted on this *network* echo by pointing their "tail" at the hybrid. Thus, a properly provisioned voice enhancer in the near end protects the far end caller from hearing an echo of his or her own voice and an echo canceller in the far end protects the near end. In other words, every circuit must have at least two echo cancellers in it to protect *both* users. In wireless networks meshing with third party local PSTN providers, this may be problematic as the local PSTN interface may not have this capability installed and the total round trip delay of the wireless call (150 - 200ms) will magnify the perceived echo for the wireless caller.

Acoustic Echo: Strictly speaking, Acoustic echo is generated by the retransmission of a previously sent voice stream after a short, but noticeable period of time. This may occur in one of two ways: acoustic isolation echo or ambient acoustic echo. The first type, acoustic isolation echo (or acoustic coupling) is generated when the earpiece and microphone are poorly isolated from one another (less than 45dB per ISO 54). Unfortunately, this is often the case with many of today's small wireless handsets, but is sometimes seen in poorly designed cordless wireline sets as well. For instance: a wireless user is having trouble hearing in a noisy environment and turns up the speaker volume to maximum, then holds the phone in such a manner that there is poor isolation between the speaker and microphone. The use of leather carrying bags also exacerbates this problem. The second form is the less common, but annoying ambient acoustic echo. Generated when a telephony conversation is held in an acoustically reflective space, the handset microphone first picks up the original audio stream, then the speech reflected from the walls. It is most likely to occur when a "hands free" detached microphone/earpiece

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combination is used. For either situation, a remedy is provided through the use of an Acoustic Echo Control (AEC) feature, which monitors this typically low level, non-linear signal for canceling. As one would expect, proper treatment of this waveform requires a non-linear processing algorithm to be most effective. Refer back to figure 2 to note this feature is "pointed" at the wireless user, *not* in the direction of the tail as it protects the wireless user, not the far end user.

Effects on Intelligibility

Referring to figure 1 we recall intelligibility consists of multiple related factors. Attempts to control background noise may easily affect voice tonality if applied too broadly, while clipping may occur when the data stream in VoP transmissions is poorly buffered. Similarly, improper line level control may lead to distortion. Double talk is the standard speech pattern in use when two people are engaged in a conversational speech where they talk over the beginning and end of their partner's sentences. Lastly, jitter in packet networks is created when packets are lost, delayed or (rarely) mis-ordered in the bit stream. To lessen the occurrence of jitter drop out, many manufacturers add a dynamic buffer to gateway designs. Thus buffers contribute hugely to the round trip delay inherent in packet networks (see figure 6 tables detailing the delay due to buffering.

Anti-echo devices create a mathematical model of outgoing speech then "listen" for that pattern to come back on the return where upon an opposite and matching signal is added to the data stream, thus canceling the echo. Unfortunately, this process requires the canceller to recognize the difference between the reflected (echoed) speech and that of the far end talker without eliminating low level far end talker speech such as youngsters or other soft spoken people.

The Emerging role of Voice Enhancers

Over the years, techniques for controlling echo have evolved from simple echo suppressors to one-dimensional echo cancellers to today's voice enhancers capable of effecting multiple factors beyond network generated echoes, such as background noise, speech clipping, and network levels. Figure 4 illustrates the range of conditions and direction these features act upon. For instance, Hybrid (or network) echo cancellation is "pointed" toward the PSTN hybrid to cancel the echo generated by the near end (PSTN) hybrid and heard by the far end wireless user. For Voice Quality features depicted in figure 3, the convention is arrows point in the direction of their effect. For example, noise reduction *effects* or *acts upon* background noise present in the wireless side of the circuit and Automatic Level Control (ALC) is a bi-directional feature acting on line levels in both directions.

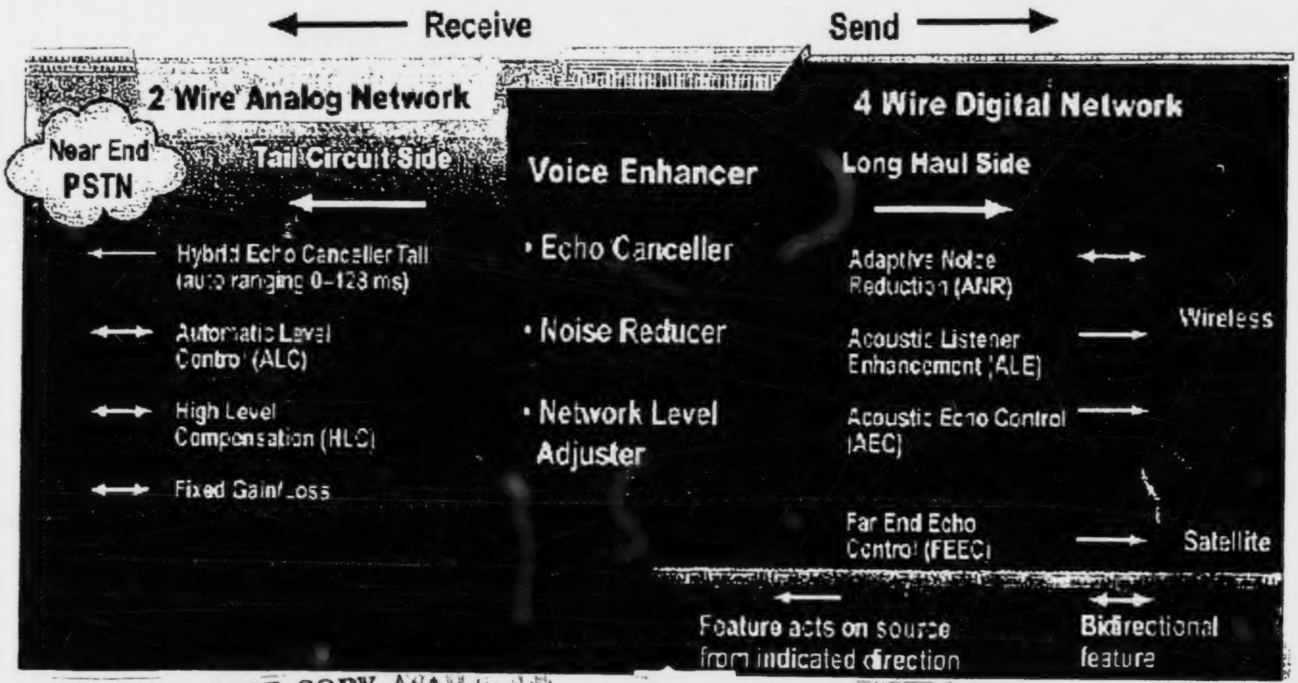
Receive
Send
2 Wire Analog Network
4 Wire Digital Network
Near End PSTN
Tail Circuit Side
Voice Enhancer
Long Haul Side
Hybrid Echo Canceller Tail (auto ranging 0–128 ms)
Automatic Level Control (ALC)
High Level Compensation (HLC)
Fixed Gain/Loss
• Echo Canceller
• Noise Reducer
• Network Level Adjuster
Adaptive Noise Reduction (ANR)
Acoustic Listener Enhancement (ALE)
Acoustic Echo Control (AEC)
Far End Echo Control (FEEC)
Wireless
Satellite
Feature acts on source from indicated direction
Bidirectional feature

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Figure 4: Voice Enhancers - The New Echo Cancellers

A bit of explanation on those features which turn an Echo Canceller into a Voice Enhancer for those features not mentioned below. Background Noise Reduction (NR) - of keen interest by today's wireless operators is the use of background noise control. Several methods exist to recognize background noise from natural human speech then eliminate or filter the offensive portion out as heard by the far end user. There are two principal ways to accomplish this: attenuation or elimination. Some algorithms eliminate noise entirely and while this may seem effective, the result is a sterile conversational environment that has none of the intrinsic quality of a mobile call. The attenuation methods examine the background levels and attenuate those to an acceptable level. The trick with both methods is accomplishing the task of noise reduction without interfering with either the voice tonality or information content (no clipping) of the call. Acoustic Listener Enhancement (ALE): modern voice enhancers are smart devices When the NR function is engaged and operating, the Voice Enhancer "knows" the wireless caller is calling from a noisy environment and boosts the signal going to the wireless handset to make it more intelligible for the wireless caller. Automatic Level Control (ALC) and High level Compensation (HLC) are subsets of a single feature allowing network engineers to set a desired level for the network. Thus, a gateway country no longer needs to experience "hot" or "cold" calls from areas with poorly regulated networks which adversely effects voice quality in their region.

Deploying Voice Enhancers in Next Generation Networks

CASE ONE: SATELLITE BASED HUB and SPOKE NETWORKS: Satellite based networks have several special considerations: compression, long tail length delays, and remote site hub sites. Hence, the use of traditional echo cancellers may be ruled out, as they possess neither a long enough tail capability - 96ms is typical; 250ms is required - and perform poorly in wireless local loop applications in the tail.

A new generation of adaptable voice enhancers provides adaptable tail capabilities between 128 and 688ms - a feature called (Far End Echo Cancellation) FEEC. Proper placement *before* compression eliminates the introduction of quantization errors. Coupled with advanced voice quality features such as Acoustic Echo Control (AEC), network line leveling (ALC & HLC), and noise reduction (NR) these voice enhancers are flexible voice quality tools enjoying the advantage of requiring single location deployment to protect an entire network. In these applications, two voice enhancers are set back-to-back at the central Hub site: one pointed toward the PSTN, the other, a specially provisioned VE with FEEC pointed toward out toward the VSAT network. This placement allows a single placement to cover huge distances and simplifies maintenance and provisioning issues. The FEEC-enabled voice enhancer essentially "reaches over" the 250ms transmission distance, to adaptively cancel the hybrid echo in the far end.

CASE TWO: VOICE OVER PACKET AND VOICE BACKHAULED OVER DATA NETWORKS: Packetized voice for wire line networks is *the* new frontier, the place where convergence is being tested today. In this section we will explore the role of voice enhancers and voice quality in these converged networks and correct several myths: Packetized networks are all digital and thus do not need echo cancellation; Network delay is an inconvenience, not a problem; "Tail delays are always short"; "

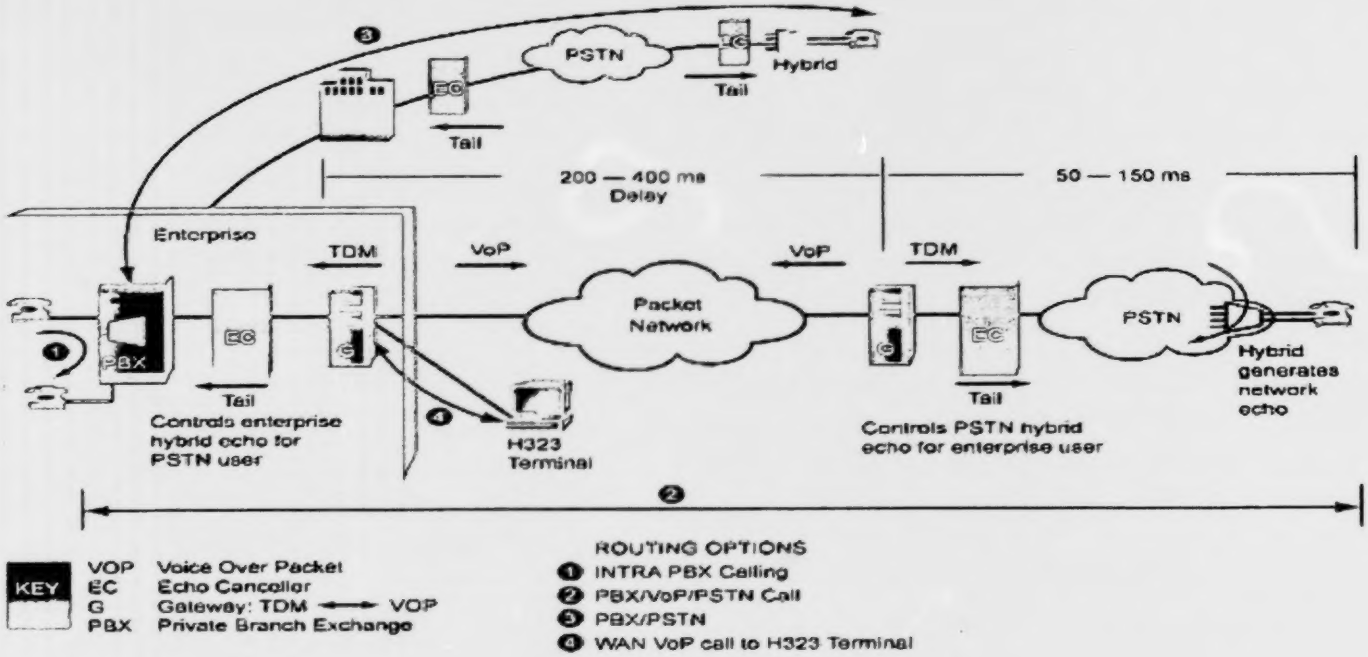
③
PSTN
Hybrid
Tail
EC
Tail
200 — 400 ms
Delay
50 — 150 ms
Enterprise
TDM
VoP
VoP
TDM
Packet
Network
PSTN
①
PBX
EC
G
G
EC
Tail
Controls enterprise
hybrid echo for
PSTN user
④
H323
Terminal
Tail
Controls PSTN hybrid
echo for enterprise user
Hybrid
generates
network
echo
②
KEY
VOP Voice Over Packet
EC Echo Canceller
G Gateway: TDM ⟷ VOP
PBX Private Branch Exchange
ROUTING OPTIONS
① INTRA PBX Calling
② PBX/VoP/PSTN Call
③ PBX/PSTN
④ WAN VoP call to H323 Terminal

Figure 5 - Typical Voice over Packet VPN Topology

In figure 5, we explore the most common VoP topology options: intra-PBX calling, PBX/VoP/PSTN calling (common in VPNs), PBX to PSTN (non-packetized), PBX to H323, or H323 to H323 calling. Echo problems are alive and well in *all* telephony connections except *pure* digital-to-digital connections. As figure 5 illustrates, digital calls are seldom-pure *digital* and other sources of impedance mismatch exist other than network hybrids.

While it may be possible for a closely controlled VPN to achieve an all-digital transmission path, for any application connected to the PSTN however, the possibility of a *pure* digital call is remote at best. Due to regulatory conditions, it is unlikely *all* analog phones will be phased out anytime soon. For as long as grandmas Black Bakelite rotary phone is in the network, a 4-to-2 wire hybrid/echo generator will exist. For pure digital calling, say an H323 to H323 loop, the call is indeed pure digital and a network echo may not be present, but users report other problems including line levels, network noise, extreme latency and acoustic near end coupling. For the H323 terminal to PSTN-terminal call network echo is present. This last case is illustrated in paths 2 and 4 above where the VPN sets up a near-end digital local loop connected through a packet backbone to a far-end PBX or PSTN.

At first examination, a PBX, though a digital element, would seem to not be a problem. Experience has shown however, a PBX may act as a network hybrid with a small amount of impedance mismatch between the enterprise network and the PSTN or external network. Imagine for a moment a PBX does not have this capability and does indeed generate some small amount of echo (say -20 db). Recalling the echo and delay interaction chart of figure 2 we recognize this small ERL multiplied by say 222ms of delay (see figure 6) equals poor voice quality. Thus, an echo is delivered back to the far end caller if an echo canceller is not placed in the enterprise network pointed toward the PBX. In this case, the tail capability need only be a short 5 - 10ms - usually adequate for local enterprises networks.

"Tail delays are always short," and "I'm only running a short loop VoP." Strictly speaking, a controlled packet network where the geographical limits are both bounded and known this is true. However, neither of these conditions is likely to hold for VoP networks where anything but a well-regulated CBR (or other priority QoS schema) is used. Then there are compression algorithms. As shown in figure 6, framing for a G723.1 algorithm may take up to 35 ms, buffering 25 - 50ms and packetization an additional 30ms - all within the gateway device *not including transmission.* In connectionless data networks such as IP, transmission latency can be a millisecond time sink where packet "A" is routed over one long distance route and packet "B" proceeds over another, consuming both transmission time and buffering time.

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By way of example, several cellular providers have reported voice quality problems when using data networks to backhaul voice over distances normally considered "local." In these cases all-digital networks are seeing sever echo problems on some calls when those calls are backhauled over data networks. The measured delays are 172+ ms7.

CASE THREE: WIRELESS CALLING - TDMA / CDMA: Today's wireless telephony market is dominated by two standard formats: IS-41 (TDMA, CDMA) and GSM (ITU-900 & 1900). The two are similar only at the end user level, for implementation they are quite different. We will discuss TDMA / CDMA first as many details applied here apply toward an understanding of GSM topology later.

As both TDMA and CDMA are legacy systems with an analog component, network echo can con be ruled out even in the wireless to wireless calling scenario. For instance, a wireline caller (the near end) places a call through a traditional PSTN wireline network to a wireless user on the far end. Echo cancellers at either end of the network protect *not* the caller nearest them, but the caller at the *opposite* end. Recalling that echo cancellers remove echoes generated by network hybrids, and noting the existence of only one hybrid in this system, at the near end within the PSTN, we conclude an echo canceller must point toward the PSTN to protect the *wireless* caller. As most Local Exchange Carriers (LEC) do not provision their networks with echo cancellers, and wireless loops have processing / transmission delays of typically 200+ms (reference figure 6) the wireless service provider must place an echo canceller on the PSTN side of the MSC before a handoff to the LEC.

Recalling diagram 3, the acoustic echo control feature points in the opposite direction from the hybrid echo control feature, that is toward the wireless user, thus protecting the wireline caller. As was discussed above, acoustic echo may be generated by poor isolation in the handset due to either poor design, limited microphone to speaker separation, or environmental factors. Hence while the acoustic echo control (AEC) feature primarily protects the wireline caller from wireless generated acoustic echo, it also protects the wireless caller from acoustic feedback generated by their handset. A distinct rapid return echo sounding similar to musical "reverb" characterizes networks without this feature.

In TDMA/CDMA networks it is common to put Voice enhancers back-to-back off the switch to handle mobile-to-mobile calls. That is, their tails are pointed in opposite directions. Why? Simply put, Acoustic Echo control, Adaptive Noise Reduction (ANR), and Automatic Listener Enhancement (ALE) are performed in only one direction - opposite the tail direction. Hence, using two enhancers, in a back-to-back configuration is necessary to protect both callers from both Acoustic Echo, and background noise. If however, the service provider is unconcerned with ALE and ANR in *both* directions, a single Voice enhancer may be employed. For Mobile to PSTN calls, a VE must be installed at this interface to protect the mobile caller from network echo.

CASE FOUR: WIRELESS CALLING - GSM: GSM / PCS networks are wireless networks engineered to accommodate both networking and radio technologies and are not *directly* compatible with IS-41 (TDMA, AMPS, CDMA). Engineered to be all digital networks from the ground up, generally speaking GSM networks avoid the most common network echo issues. Aside: some PCS service providers use IS-41 technology while others use the PCS 1900 standard - a special implementation of GSM900. The confusion continues.

How and where do voice enhancers fit into GSM networks and what do they do? Typically, a VE (voice enhancer) is installed on the "A" interface between the MSC and BSC (mobile switching center and base switching center). As we shall see later, this arrangement visa via the one favored by those in TDMA networks discussed above is immediately seen as more cost effective as it funnels all calls, whether they be wireless to wireless or wireless to wireline through a single voice enhancer. However, as seen above, for full effectiveness, the VE must have a bi-directionally enabled AEC, and ALE. This schema may save up to two times the cost over the back-to-back arrangement favored in TDMA networks where the comparable "A" interface transport is *not* TDM and VE's are ineffective as discussed earlier.

CASE FIVE: CONVERGING DATA AND VOICE IN GSM NETWORKS: As wireless networks move into the new world of converged data and voice, a need exists for voice enhancers to accommodate voice through what is normally a data channel. In GSM networks, where the "normal" 2100hz in-band, channel clearing tone for data is not available, an emerging standard called Tandem Free Operation (TFO) performs this function. TFO is designed to improve voice quality by allowing the voice signal to bypass intermediary transcoding operations, thus limiting any potential quantization errors.

PSTN Transmission Processing Delays

Transmission Equipment	Processing Delay (milliseconds)
Transmultiplexer	1.800 to 6.00 (each conversion)
Digital switch	0.500 to 1.200
MUX	0.500
ADPCM transcoder	0.250 to 0.500
PCM channel bank	0.125 to 0.500
Digital cross-connect	0.25
DCME	0.020 to 0.050

Typical Voice Over Packet Processing Delays

Source	Latency (milliseconds)
Source Network Interface	1 (1.544 Mbps T1)
Framing	30 (G.723.1)
Coder Processing Time	10 (worst case)
Jitter Buffering	20 - 80 ms
Packetization	30 (two frames per packet)
Media Access Delays	10 (5 - 2 msec hops)
Routing	50 (router dependent)
Decoder Processing Time	10
End-point Network Interface	1 (1.54 mbps T1)
Total One-way Latency 222 msec	

REF: July 2000 **Network Magazine**. "Reducing Voice Over IP Latency"

Mobile Delays (Propogation + Processing)

Standard	Mobile to Mobile	Mobile to PSTN
GSM	360-400 ms	180-200 ms
TDMA	360-400 ms	180-200 ms
CDMA	360-400 ms	180-200 ms

Compression Delays

Algorithm	Data Rate	MOS Score	Delay (msec)
G.711 (PCM) VoATM Specify this coding	64.0 kbps	4.4	0.75
G.726 (ADPCM)	32.0 kbps	4.2	1
G.723	5.3 kbps	3.5	25 - 35
G.728 (CELP)	16.0 kbps	4.2	3 - 5
G.729 (ACELP)	8.0 kbps	4.2	10
G.729a (ACELP)	8.0 kbps	4.2	10

REF: 1999 Cisco Web Tutorial. "Packet Voice Primer"; Summer 2000 Applied Computing "A revolution in Voice Networks"

Propagation Delays

Transmission Facility	Delay (milliseconds/kilometer)
Loaded VF cable	.205
Non-loaded VF cable	.012
PCM over coax	.006
Fiber optic cable	.006
Microwave radio	.003
Satellite	250 (single hop - one way)

Miscellaneous VoP Network Delays

Transmission Facility	Delay (milliseconds)
IP Buffer	20 - 80
Typical Corporate Network Delay	300 - 400
Gateway Latency	
Cisco	65 ms
HyperCom	128 ms
Lucent	100 ms
RADvision	150 ms

REF: 4/98 Data Communication. "Voice Over IP"

Figure 6 - Processing and Propagation Delay Tables

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Mr. Hult received his BS in engineering from Clarkson University, Potsdam NY, and earned both an MS Engineering and MBA from Santa Clara University, Santa Clara, California.

Previous to joining Ditech, he was employed at Lockheed Martin Telecommunications as Business Development Manager for broadband delivery systems, and as an independent consultant on telecommunications business cases. His technical experience includes: antenna design, digital electronics design, electronics packaging and manufacturing, satellite systems, communications systems engineering; and mechanisms design.

Ditech Communications Background

Ditech designs and manufacturers voice quality products and optical networking equipment for telecom carriers worldwide and currently counts among its customer base four of the top five long distance carriers in North America. A successful Silicon Valley, company with a 10 year track record, Business Week magazine recently ranked Ditech Communications among it's top hot growth companies for 2000 after revenues grew ten fold from FY 1998 to FY 2000.

Web Address: www.ditechcom.com

Back to preceeding page **Back to the sessions page**

Advances in Optical Networking Technologies and its Benefits to Service Providers and End Users

Don Frey, Bill Erickson, and Paul Morkel

Abstract

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Introduction

The world of optical transmission is currently undergoing rapid change as a result of explosive growth in Internet and other data traffic. To meet the demand of the 21st Century network, new transmission and switching technologies are being planned and implemented at an unprecedented rate. With the widespread adoption of optical amplification and the advent of all optical switching, the era of the Photonic network has arrived, providing transport and switching for voice and data traffic with bandwidth costs at a fraction of only a few years ago.

Optical Network Drivers - why is it needed?

The growth of the Optical Network is being increasingly driven by demands of data transport requirements for Internet, corporate data and multimedia distribution. In addition, businesses, ISPs, and new carriers are looking to new types of services, such as wavelength services to meet the demand for bandwidth, bandwidth growth, and security. Business and education is increasingly being conducted via Email and web-based applications such as E-Commerce and Distance Learning. Information distribution is also rapidly migrating to web based services. Residential users are becoming accustomed to ubiquitous connectivity provided by wireless, cable modems or DSL and also the large increase in bandwidth provided by many of these new services. The Internet provides the universal application and data infrastructure for the new age, which relies on the Optical Network to provide Nationwide and International optical transport. Key new facilitating technologies include 40Gbps TDM transport, 10Gigabit Ethernet, and Terabit Optical Networking Systems.

The Optical Network will co-exist with traditional and Next Generation SONET Networks, which indeed will migrate to incorporate many common features with the Optical Network. In particular the Control Plane of the network is likely to show high commonality with transport equipment types being optimized for operation at different points in the network.

Figure 1 shows a view of the transport network from access to nationwide transport with identification of the services and equipment types required at different points. The main near term application for Optical Networking technologies will be in the core, or the long haul segment. As bandwidth demands grow, the Optical Network is expected to extend into Regional and Metropolitan applications.

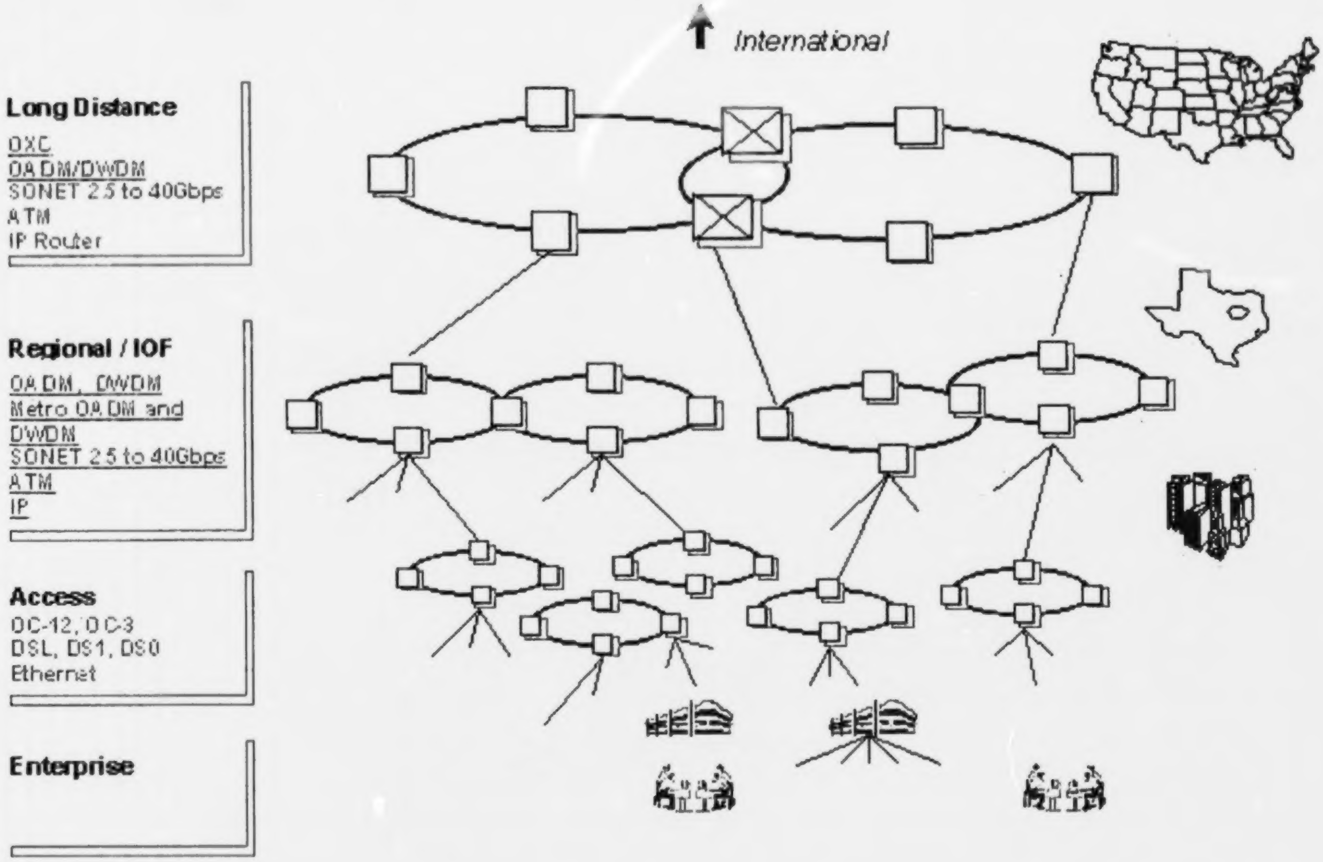

Figure 1: Optical Transport Network

Next Generation Optical Transport - how much bandwidth?

Typically today DWDM transmission systems provide up to 320Gbit/s in the core of the transport network with a combination of 10Gbit/s and 2.5Gbit/s wavelengths in service. By the end of year 2000, network capacity greater than 1.6Tbit/s capability will be introduced. Primarily 10Gbit/s channels are expected to be used on these systems although 2.5Gbit/s channels will also be possible. In addition to this ultra-high capacity capability, the next generation of DWDM transmission equipment will provide substantial savings in per wavelength costs by providing ultra long haul configurations. In this case, the 3R-transmission distance is substantially increased removing the requirement for per-channel intermediate regeneration, which adds cost to the system. Optical ADMs will be utilized to cost effectively terminate a subset of wavelengths at intermediate sites. Beyond Optical ADMs, the next migration is expected to be to the 3.2-6.4Tbit/s range, which will be enabled by incorporation of 40Gbit/s wavelength adaptation. Such systems may need the latest generation of optical fibers for transmission to provide cost effective solutions.

Optical Networking Intelligence - how will it be managed?

Greater embedded intelligence will be implemented in the transport network elements to decrease the expense in managing the network as well as to increase the rate of service provisioning. Intelligent Optical Networking using a MPLS control plane will allow carriers to offer new services based on dynamic bandwidth allocation,

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fast restoration techniques and flow-through provisioning. MPLS for Optical Network applications (MPIS) is currently being standardized and is expected to be a ubiquitous control protocol for management of wavelengths in the Optical Network. MPLS will also be implemented in Next Generation SONET networks providing a ubiquitous and universal control and management architecture for the whole network.

A number of proposed network models for enabling the network control plane currently exist, including Overlay Network, Integrated/Augmented, and Peer Model. At this time much standardization activity is focussed on the Overlay Model and the Peer Model. The basis on the Overlay Model is that the data (IP) layer and Optical layers are separate and the focus is on improving performance and for each. The OIF (Optical Interworking Forum) and ODSI (Optical Domain System Interconnect) are currently working to add User Network Interfaces (UNI) and Network-Network Interface (NNI) specifications such that data requirements (typically IP packets) can set-up paths on demand by signaling to Optical Network devices. The overlay model is similar to how ATM and IP work together today. The Peer Model has IP continuity and control from the edge of the optical network through the backbone of the network; i.e. there is no hierarchical relationship between data and Optical Networking equipment. The differing network models use either in-band or out of band signaling. The signaling control plane will empower service provider with the ability to provide service quickly and provide protection switching based on the type of service. The control plane will provide rapid means for provisioning of the network, Quality of Service (including restoration features), trace-ability and even service management features such as billing.

To enable the dynamic, MPLS controlled, network a number of requirements exist for functionality. These include dynamic cross connects with wavelength conversion capability (Optical Switch or Wavelength Router), in band and out of band signaling channels such as SONET overhead, Digital Wrapper overhead and Optical Service Channels. All of these features are currently being implemented by Optical Networking vendors and will be implemented on systems with Terabit transport capability and 40G channel rates.

OXC, DOADM and Dynamic Wavelength Control

Optical Cross Connects based on optical switch fabric will shortly be installed in the long-distance network. These new platforms complement the Tbit/s transmission DWDM systems perfectly by providing multiple Tbit/s of switching capability in a space of just a few racks. The optical switching capability allows restoration of services in the case of network failures without demultiplexing of the optical signal to lower rates and provides wavelength grooming and the means for dynamic allocation of bandwidth on the network. In addition, Dynamic OADMs (DOADM) offering many of the same features of the OXC in an OADM configuration will be implemented. DOADMs and OXC will work together to provide a ubiquitous wavelength control and management architecture, independent of the bandwidth needs of particular locations. Dynamic network restoration and resource allocation using wavelength-based MPLS across many network element types will become commonplace driving down the cost of provisioning bandwidth and opening the door to new and competitive wholesale-bandwidth markets.

The Next Generation Network is likely to consist of a combination of mesh connectivity and optical rings. Depending on the fiber connectivity a meshed or partially meshed network can allow more efficient wavelength resource usage than rings although in some cases at the expense of restoration time and multiple failure survivability.

Figure 2 shows a typical nationwide network with a relatively small number of large hub sites and a larger number of bandwidth distribution sites. Logical path connectivity is shown along with physical connectivity enabled by the available fiber cables. Realities of fiber connectivity means that the network will be a combination of degree 2 nodes (2 path options) and degree 3 or higher nodes (3 or more path options) meaning that full mesh connectivity between all sites will not be possible and that a combination of mesh and ring is likely.

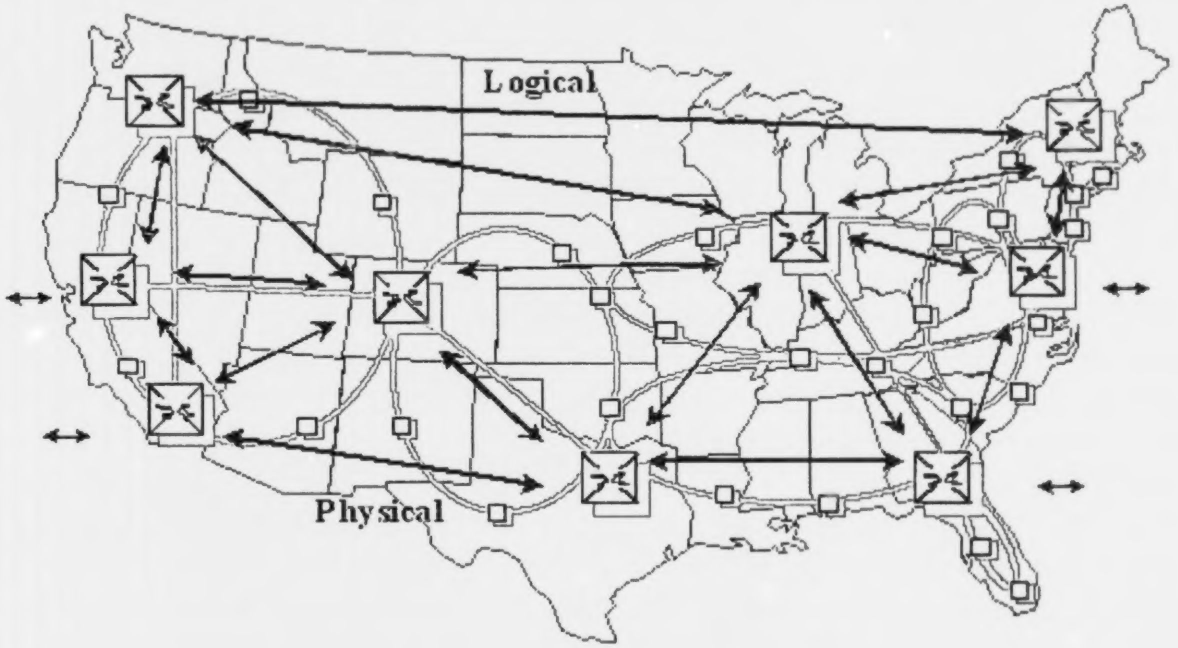

Figure 2: Nationwide Network

Evolution in Optical Technology

Carriers are beginning to deploy routers with 10Gb/s interfaces and router vendors are planning 40Gb/s interfaces to maximize throughput and consolidate ports. Rising network traffic from DSL, Wireless and Cable Modem technology will drive carriers to increase the speed on their high-speed backbone connections. To this end carriers will be required to deploy networks capable of handling multi-terabit systems that work over both short and long distances.

Key new technologies being implemented in the Optical Network include Distributed Raman Amplification, Advanced Dispersion Compensation, PMD Compensation and Digital Wrappers. Raman amplification utilizes the transmission fiber itself as an amplification medium. Raman gain allows the optical transmitters to send signals at lower power levels thus decreasing non-linearity impacts on transmission systems that would otherwise compromise Tbit/s and ULH transport. Other optical techniques include Chromatic Mode Dispersion and Polarization Mode Dispersion compensation , which enable 10Gbit/s wavelengths and 40Gbit/s wavelengths to be transmitted over greater distances.

Digital wrappers are a new layer of overhead that is added to signals as part of optical networks. Digital wrappers help improve network capabilities with control information and Forward Error Correction (FEC). Digital wrappers with FEC increase performance substantially, increasing bandwidth and transmission distance capabilities substantially [1]. Use of the Digital Wrapper overhead can allow a carrier to isolate faults, performance monitoring, and support protection switching. Digital wrappers can provide an in-band (per wavelength) signaling channel between optical devices. Essentially digital wrappers would set-up paths or optical channels between OXCs either during initial set-up of the optical channel or establishing a protection path based on a network disruption.

Optimization of the available optical spectrum is another of the most important targets in optical networks. To date, there is unified channel spacing in each DWDM system no matter whether it is a passive device or an active device. In other words, the signal spectrum, assigned to each port, has the same width. So the development of flexible tunable channel spacing(TCS) DWDMs, will allow carriers to better optimize wavelengths within the network. With TCS-DWDM channel spacing, bandwidth assigned to each port is programmable / tunable. Hence, a TCS-DWDM system can support a mixture of 2.5 Gbit/sec, 10Gbit/sec, and 40Gbit/sec wavelengths in which each client wavelength receives the appropriate fiber spectrum allocation, as opposed to the same fiber spectrum allocation.

Summary

Optical networking advances such as Terabit transport, Ultra-Long-Haul transmission and MPLS will provide unprecedented bandwidth in the transport network with substantial reductions in the unit bandwidth cost. NG DWDM, DOADM and OXC are all expected to be deployed in the near future. As an example if we assume that unit bandwidth cost doubles every year, the price of a 10 Gb private line by the middle of the decade will be the same as that of an OC-3 today. Looking at a 10Gbit/s service between New York City and Washington D.C. we may expect the price to reduce to the region of thousand USD per month compared with several hundred thousand USD per month today.

Reference

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Back to top of page   Back to the sessions page

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Donald Frey joined Fujitsu Network Communications, of Raleigh, North Carolina, in 1999. He is currently a Distinguished Strategic Planner responsible for the strategy for Optical Networking Solutions. Before coming to Fujitsu, Mr. Frey was with Cincinnati Bell for 11 years, where he planned and led deployment of SONET, IP, and broadband networks. Mr. Frey is a registered Professional Engineer and has an undergraduate degree in Electrical Engineering from Purdue University and a Masters Degree in Business Administration from Xavier University.

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Back to proceeding page   Back to the sessions page

A Framework for End-to-End Quality of Service

Jingsha He and Takafumi Chujo

Abstract

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1. Introduction

The growth of the Internet has significantly increased its commercial use for video, audio and multimedia applications that require the guarantee of quality of service between endpoints, i.e., the client and the server. Current technologies and practices take the approach of reserving the required resources such as network bandwidth to meet the quality of service requirements. If the resource requirements could not be met, the applications would not start or other alternatives would be sought to locate the necessary resources. This approach has the disadvantage of taking long time to set up the execution of the applications without any guarantee that the resources would be obtained. The applications could not immediately start until the lengthy process of reserving the required resources is completed.

We propose a framework for end-to-end quality of service in this paper. The framework is based on policy-based networking (PBN) architecture with network measurement capabilities. The PBN allows the user to specify the quality of service requirements for starting applications. The network resource requirements for each application would then be matched up with the user's quality of service requirements. Because different users may have different expectations on the quality of service, the resource requirements may be different for the multiple invocations of the same application. The user may also specify multiple levels of quality of service that are acceptable in the PBN so the application could start at a degraded level if there were not sufficient resources for starting the application at a higher level of quality. A lower level of quality could also be requested explicitly by the user for considerations such as lower charge for the service or less important event even though the resources are available for starting the application at a higher level of quality.

The other main element in the framework is the network measurement capabilities. The measurement modules will continuously monitor and gather network traffic data and initiate measurement actions whenever necessary to compute the available network resources. The measurement results will be supplied to the PBN to be used for matching up the available resources with the resource requirements for the different levels of quality of service. Therefore, it immediately becomes known to the PBN that applications can start between which endpoints and at levels of quality. When the user requests the application or service, a decision can be made right away by the PBN regarding whether the request can be satisfied. Even if resource reservation is still needed to guarantee the quality during the service, there is a much higher chance that the resource reservation would be completed successfully.

The advantage of the proposed framework for end-to-end quality of service over the current practices is that it can immediately respond to user requests about resource requirements and availability and can lead to a much higher chance of obtaining the required resources. This is because the PBN has the necessary information to respond quickly and to know how to obtain the resources, which is a major improvement over the current technologies and practices.

The rest of the paper is organized as follows. In the next section, we describe the framework for end-to-end quality of service in which we concentrate on the PBN architecture and the network measurement capabilities. In Section 3, we describe a couple of applications that can take advantage of the benefits out of the framework. Finally, we conclude this paper in Section 4.

2. The Framework

In the framework for end-to-end quality of service, we introduce two components into the present quality of service paradigm: the policy-based networking capability and the network measurement capability. The layering of the components inside the present network is illustrated in Fig. 1.

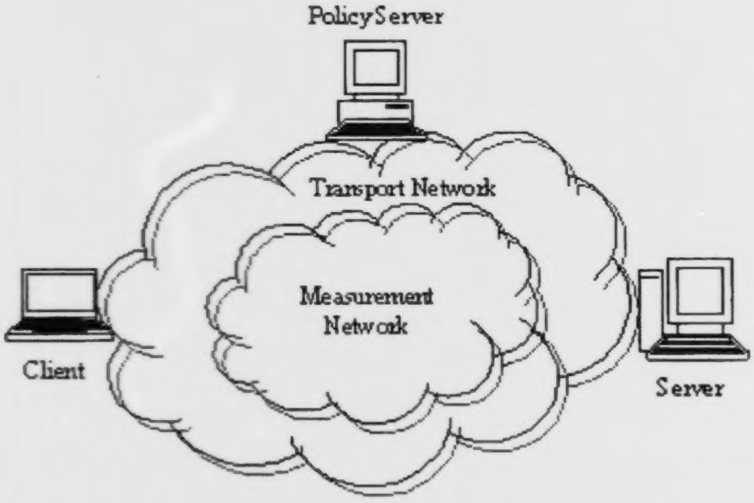

Fig. 1. End-to-End Quality of Service

In the framework, a measurement network is built that could also rely on the same transport network that delivers the quality of service between the client and the server. The measurement network just implements some necessary functions to facilitate the measurement services it provides to the policy server and, consequently, to the quality of service applications. The other component in the framework is the use of the policy server for policy-based networking services. The policy server is itself could be implemented as a network of servers that support different functionalities. In our framework, however, it is illustrated by using a single server that, we assume, would implement and support the PBN requirements. We describe the two components of our framework, i.e., the PBN and the network measurement capabilities in the remainder of this section.

2.1. Policy-Based Networking Capability

The policy-based networking component consists of one or more policy servers throughout the network that administer and enforce the various policies related to quality of service for applications. The policy-based networking (PBN) adds the following capabilities into the quality of service applications on a dynamic basis:

1. Policy configuration and management. The policies are used to specify the resource requirements of

the various applications. Since the policies will be utilized in real time before applications start, more complex and dynamic policies can be used for better quality of service request and control and for better network resource utilization. For example, an application can specify that different levels of quality of service be provided at different time of the day or depending on the available resources at the time of the invocation or the specific events that cause the invocation. Therefore, quality of service can be degraded or upgraded corresponding to different times, events and network situations. It may also relate to the different charges by service providers for the quality of service. This capability is conducted through an interface between the policy server and a system administrator or directly with the resource specification scripts of the applications.

2. Resource information aggregation. The policy servers can serve as the aggregation points for resource allocation status. The status can be updated periodically through interacting with the network measurement component or can be obtained when certain status information is needed for the policy servers to make a decision regarding quality of service. The advantage of the first approach is the instantaneous availability of the status information when a decision has to be made, while that of the second approach is the lower overhead in the maintenance of the network resource information. Depending on the scope of the policy utilization on the applications, one approach could be more advantageous over the other. For example, if PBN is widely used by applications for quality of service, the first approach would make more sense because the information is constantly needed and, therefore, the overhead becomes comparable to that of the second approach. In the beginning where fewer applications use the PBN for quality of service, if overhead is a primary concern, the second approach may be more practical provided that the delay for getting the status information can be tolerated.
3. Decision-making. When an application sends a query to the policy server regarding the availability and allocation of network resources for starting the application, the policy server will gather the necessary information about the resource situation in the network to decide whether there are sufficient resources for the application. If the query specifically requests a certain amount of resources, the policy server will check with the policies to verify that the request stays within the limit of the policies. If the query does not specify a resource amount, the policy can retrieve the resource requirements from the existing policy based on the time and circumstance of query. If the policies are flexible, the policy server may also set the resource requirements based on the current situation of the network. Ultimately, the policy server will issue a decision to the application regarding whether there are enough resources for the application to start. If resource reservation is required for the application, the policy server will get updated regarding the available resources soon whether or not the application is able to reserve the resources and starts to execute. The resource reservation is not necessarily a function in the PBN, by the way, and, rather, should be carried out separately by another functioning component in the network, whether it is the application itself or not.

With the above functionalities in the PBN, we can see that the PBN, or more specifically the policy servers, is the resource policy management and enforcement point in quality of service applications. This is because the applications will go to the PBN for all resource allocation and reservation decisions. This is also because the PBN keeps track of all the resource information in the network that facilitates the resource management and enforcement functions.

Fig. 2 illustrates the policy server functionality in the PBN and the interaction with other components in the framework.

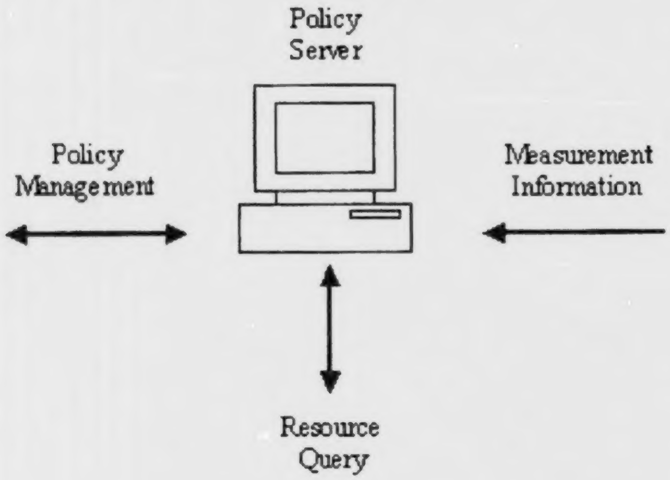

Fig. 2. Policy Server in the PBN

2.2. Network Measurement Capability

Network measurement is an important component in the framework because it makes it possible for the PBN to make resource management and enforcement decisions regarding network resources. The network measurement component keeps track of the resource utilization information by regularly measuring the various metrics related to the performance and characteristics of the network. Among the most commonly used measurement metrics are one-way traffic delay, round-trip traffic delay, traffic loss ratio, bandwidth of paths, etc. Therefore, specific technologies and techniques are needed to measure the different metrics. Multiple measurement agents can perform the measurement against other network nodes and the individual results obtained have to be combined to provide a network view regarding the performance in order for the results to be useful for the upper layer network services or applications. Therefore, we propose a two-layer architecture for the network measurement capability. The lower layer is called the measurement layer and the upper layer the information aggregation layer as shown in Fig. 3.

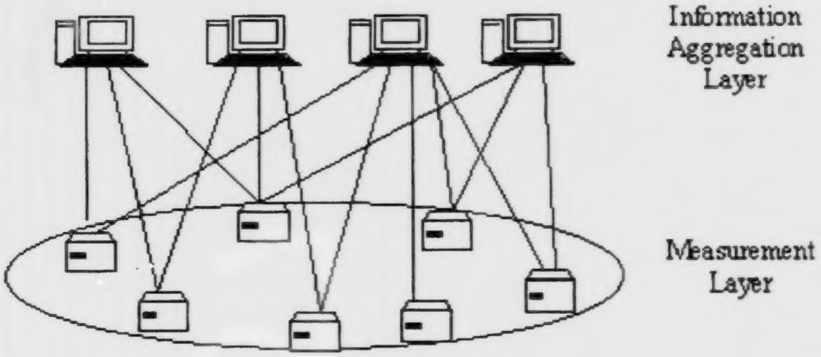

Fig. 3. Network Measurement Component

In the measurement layer, there are a number of devices that conduct regular measurement among them. These devices are located inside the network and along the edge of the network. Each of them performs the measurement representing a part of the network or a group of devices and servers on the higher layers of the network. Therefore, the number and location of these devices determine the accuracy of the measurement because the more of them there are, the smaller the part of the network that each has to represent. In addition, these devices should be evenly located in the network so that the network measurement results can be available from everywhere in the network. The specific measurement technologies and the kind of measurement they perform are out of the scope of this paper, however. Furthermore, it is advantageous to separate the architecture of the measurement from the particular measurement techniques so that any available technologies can be easily installed and executed in the measurement devices to perform necessary network measurement functions as the need arises.

In the information aggregation layer, the measurement results from the measurement devices are combined together for use by the upper layer services or applications. The aggregation can be tailored to suit particular needs, i.e., the aggregation servers can be configured to obtain the measurement results from a subset of the measurement devices. The configuration can be dynamic that new measurement devices and results are connected to an aggregation server when it is the first time that an upper layer service or application requests such measurement results. After the connection is established, the aggregation server will start to include the new devices in the list of measurement devices from which it regularly obtains measurement results. A connection with a measurement device can also be dynamically dropped if the measurement results from the device are not requested by any upper layer services and applications for a finite amount of time because the aggregation server can assume that such results are not useful for the services and applications. Even the measurement devices can be made to dynamically start and stop certain measurement based on the demand for such measurement from the aggregation servers. Such a dynamic algorithm keeps the overhead of the network measurement component low while providing useful measurement results to the upper layer services and applications.

2.3. Integration

With the PBN and the network measurement capabilities in the framework integrated into the existing quality of service network paradigm, requirements for the quality of service for applications can be better served and the performance greatly improved. Fig. 4 shows the integration of the two new components into the network.

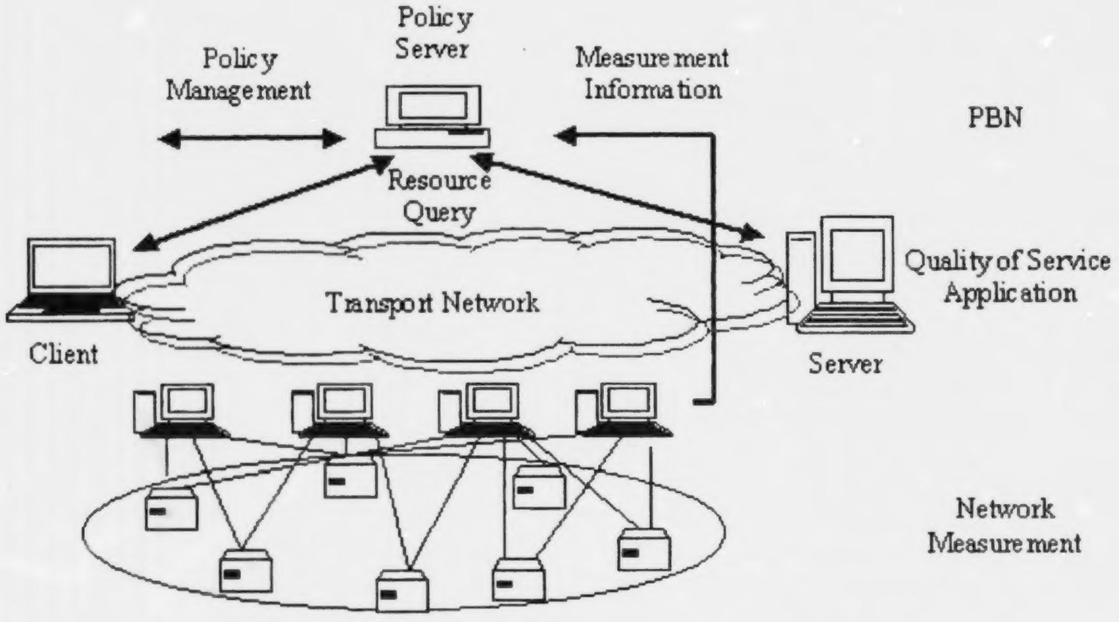

Fig. 4. Quality of Service Integration

It is therefore obvious that the different components and their functionalities in the end-to-end quality of service framework can be naturally put together to provide the quality of service more efficiently. The advantages of such architecture are as follows:

1. It can provide fast response for quality of service requests. This is in contrast to the current practice in which resources are reserved on a trial-and-error basis. Since the policy servers keep the most update information about the available network resources, a decision can be made instantaneously for a quality of service request. Even if resource reservation is still required, the reservation can succeed with a much higher probability with the information on the network resources.
2. It can support a wide granularity of quality of service requests. This is in contrast to the current practice in which the requirements on quality of service are provided at the time of the request. Since the policy servers are consulted for available resources and for decision regarding the start of the applications, different levels of quality of service can be specified for any particular application with the consideration on costs, times, events, etc. Still, the applications can specifically request a certain level of quality of service to overwrite the existing policies for the application. Nonetheless, the policy servers can decide whether to honor the specific request or to enforce the existing policies.
3. It can scale well with the needs of the quality of service applications. This is because the measurement component will dynamically start and stop certain measurement according to the needs of the upper layer applications. This is also because the measurement architecture in the framework is separated from the specific measurement techniques so that measurement algorithms and procedures can be added into the measurement devices as the need arises. The implication of the scalability is the lower overhead with the maximum benefit for quality of service applications.
4. It can be made totally transparent to the quality of service applications. This can be achieved if the

integration of the framework into the existing quality of service network is done in such a way that the applications are not required to make the queries to the policy servers. One such a way is the integration of the framework into the resource reservation procedures. Consequently, the applications would go through the normal resource reservation process without any knowledge of the existence of the two new components in the network. The resource reservation procedures, before actually carrying out the reservation, would consult the respective policy servers about the availability of the required resources. If the resources were available, the reservation procedures would continue as usual. If not, the procedures may try other alternatives before reporting to the applications that the required resources are not available at this moment. The quality of service applications would only experience a fast response in the form of resource reservation failure without knowing the functionalities of the other two components. In the case of successful resource reservation, the applications would have a higher chance of getting the resources and a fast response due to the reduction in the number of resource reservation failures.

It is therefore very obvious that the proposed framework for end-to-end quality of service can provide a great deal of benefits with very low overhead to the existing quality of service network. The framework is also suitable for both public service applications and virtual private networking applications with different administrative arrangement of the PBN and the network measurement capabilities.

3. Applications

The framework that we have proposed and described in this paper is very general and, therefore, suitable for any quality of service applications. The different requirements in the different applications are reflected in the configuration and management of policies in the PBN component and in the measurement functions of the network measurement component. In the following, we describe two types of applications to illustrate the benefits of the PBN and the network measurement capabilities in the framework to quality of service applications. We also show the differences between quality of service applications.

3.1. Public Service Applications

Public service applications are those applications that use the Internet as general transport media to conduct voice and data communications. Typical such applications that have quality of service requirements are voice over IP (VoIP) telephony services, audio and video streaming services and other pre-subscribed services that have the latency or bandwidth requirements to preserve the quality of the communications. In VoIP services, the requirements for quality of service are primarily on the latency of the transmission from one end to the other. There is little variation on the specific policies that describe how the VoIP calls should be set up. Network paths do need to be set up to preserve the orderly arrival of the packets between the two parties. Therefore, in the policy servers, the policies for the VoIP applications should state the maximum latency that can be tolerated for preserving the quality of service. In addition, resource reservation by setting up a connection between the two end points is specified to facilitate the VoIP applications.

In the network measurement, the measurement of the latency between network edge devices is required. Based on the raw measurement data, the aggregation devices in the network measurement component would compose a mesh network of end points with the attribute of latency time between them. The VoIP application, upon the initiation of a call by the caller, would consult a policy server for the establishment of a connection to the called party. Based on the current network status from the measurement component, especially the latency time between the measurement devices, and the quality of service statement in the policy server regarding VoIP applications, the policy server would inform the application of the feasibility of establishing a good connection. If the path information associated with the latency used to make the decision is also available, the setup of the connection could be guided by the information from the policy server. If no good path is available to meet the latency requirements of VoIP applications, the policy server would disapprove the VoIP application request so that the process would not continue. The VoIP application could wait for a random period of time before checking with the policy server again. It may also decide to inform the caller of the ultimate dialing failure after it has exhausted the specified number of trials with the policy server. Between each attempt, if the policy server is updated with new network measurement results, the subsequent request by the VoIP application could be approved to proceed to the connection setup phase provided that the measurement results show a reduced latency between the caller and called parties. The number of trials by the VoIP application could be a policy parameter in the policy statements for the application.

Another important public service application is the real-time audio and video streaming in which both latency and bandwidth requirements must be guaranteed to meet the quality of service. This type of applications places a higher level of requirements on the PBN and the network measurement components in the framework. In the policy servers of the PBN, the quality of service statement will include not only the latency but also the bandwidth requirements. The policy server will also have to examine additional or more complex rules in processing the requests by the application. In the measurement component, additional measurement has to be done with more aggregation effort to compute the results for the PBN. In general, the complexity of the applications with respect to quality of service is in proportional to the requirements on both the PBN and the measurement components. Therefore, more sophisticated PBN and network measurement capabilities are required to support more sophisticated quality of service applications. However, the quality of service framework proposed in the paper can meet the needs of all such applications. The additional capabilities demanded by the more sophisticated applications can be easily supported by the additional functionalities in the components of the framework without any modification in the general architecture of the framework. Therefore, the same procedure can be used by the policy server to arrive at quality of service decisions for different applications with different quality of service requirements although different levels of complexity may be incurred during the process. Fig. 5 shows the use of the framework presented in Fig. 4 for this type of quality of service applications.

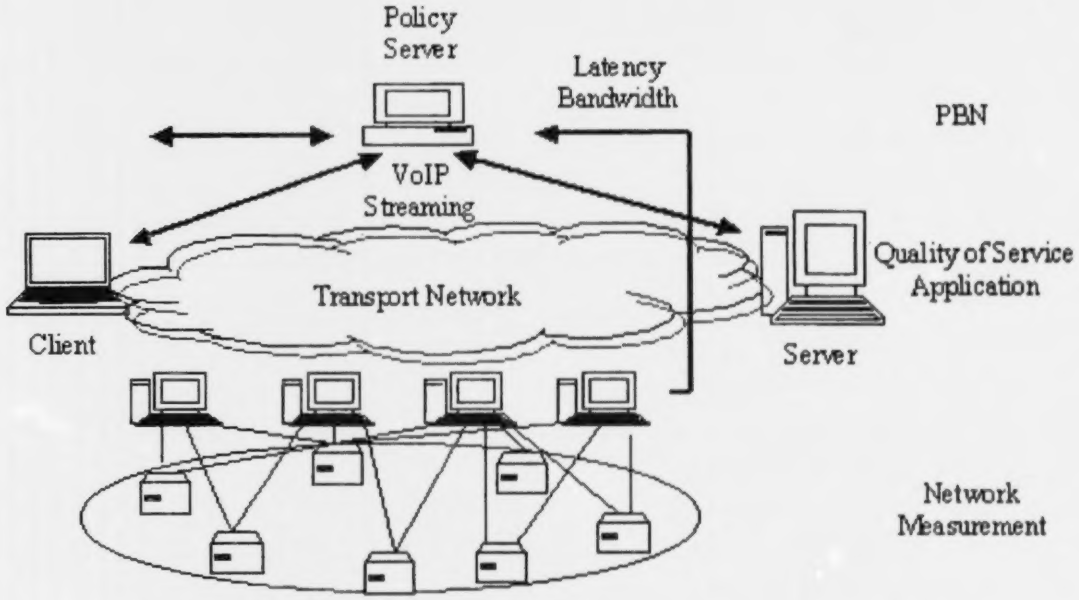

Fig. 5. Quality of Service for Public Service Applications

The other issue in the applications is the location and ownership of the policy servers and the network measurement infrastructure. The PBN can be a loose network of policy servers that can be owned by the providers of the quality of service applications. The servers can also be owned independently by third party vendors that provide the quality of service management services. The locations of the policy servers are not essential in the deployment and can even be made as part of the DNS functionality someday so that the quality of service decisions can be made while domain names are being resolved. The network measurement infrastructure, which consists of a network of measurement devices and the aggregation points, does not enjoy the same freedom, however. It is preferred that such an infrastructure be established independently and measurement services be offered as a stand-alone and generic service that is made available to all the upper layer services and applications to leverage on the economy of scale regardless of the ownership of the services and applications.

3.2. Virtual Private Networking Applications

The virtual private networking applications can also take advantage of the same quality of service architecture in the proposed framework to efficiently allocate and manage the company network resources. In this type of applications, the servers are generally located inside the company and the clients are company employees who are trying to access information and perform work-related activities with the servers. The network is just used to carry the traffic in a way that all communications can be effectively protected from public disclosure or disruption as if they were done over a private network. In addition, this type of applications and the administration of the services can differ significantly from the public service applications. First of all, the quality of service criteria may be determined not only by the application requirements but also by the company policies about how to efficiently use the company resources. For example, an application may be allocated a certain amount of resources based on the nature of the application, the importance of the application to the company business, the user who starts the application, etc. Through the control over the allocation of network resources such as the bandwidth to different applications, the company can maximize the resource utilization with respect to business objectives. Consequently, each company will have a different set of policies that best serve the goals of the company although the principle will remain the same. By exercising the control through the PBN, the company can decide the maximum amount of network resources that can be consumed by e-mail traffic, database access, web traffic, etc. When the client starts an application and queries the policy server, the decision will be made not only on the resource requirements, but also on the specific application. In addition, the user of the application can also play an important role in the decision-making. For example, a high-level executive or a customer sales representative may have a higher priority for starting certain applications to reflect the policy on business objectives. Therefore, while the quality of service architecture remains the same, the different requirements for this type of applications can be totally met through the proper policies in the PBN and the measurement in the network measurement components. Fig. 6 shows the use of the framework presented in Fig. 4 for this type of quality of service applications. It can be seen that there is no difference in the architecture between the public service applications and the virtual private networking applications. All the differences are implemented through the policies in the PBN and the measurement functions in the network measurement components.

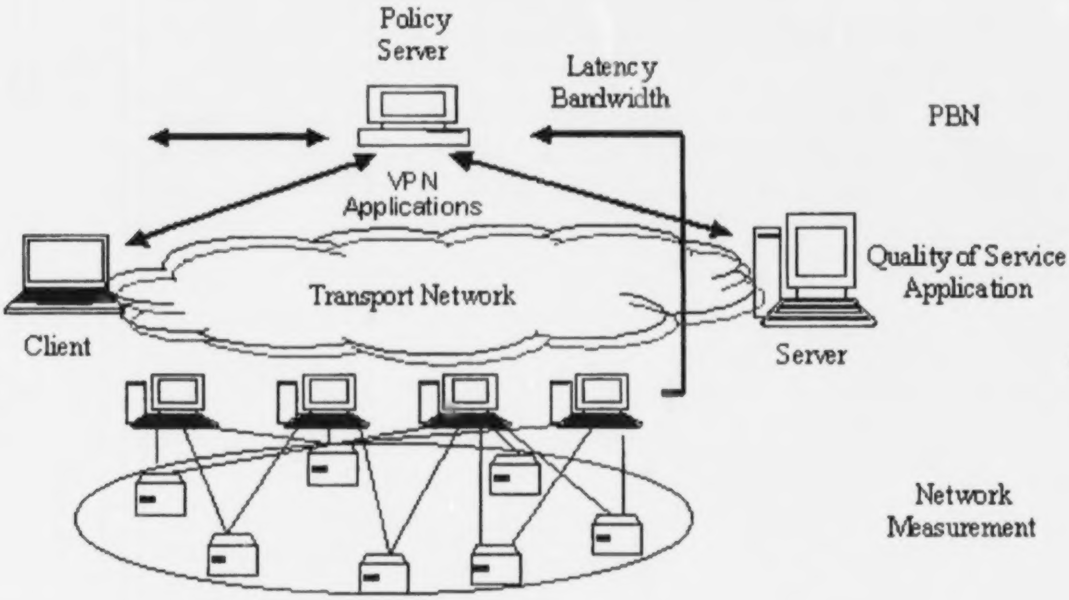

Fig. 6. Quality of Service for Virtual Private Networking

Another quality of service requirement for this type of applications is the security, which can also be effectively administered and managed through the PBN. This is because the requirement of establishing a VPN connection between the client and the server can be determined through the query to the PBN policy servers along with that for resource allocation requirement. Since the company generally owns the policy servers, all the different requirements and decisions with respect to resource and security management can be made through the same PBN policy servers.

4. Conclusion

We presented a framework for end-to-end quality of service in this paper in which we incorporated the PBN and network measurement capabilities to improve the efficiency of resource and application management. We showed the architecture and the benefits of the PBN and the network measurement components and demonstrated the importance of them for playing the critical roles in the development of a robust and scalable framework and architecture for the next generation of quality of service applications. We also described two types of applications that can use and benefit from the proposed framework and the different ways of achieving their respective objectives.

Since the development of the PBN technologies and that of the network measurement is actively being pursued by vendors with products and services being announced to the public all the times, the challenge is to integrate the technologies together to support the new framework presented in this paper. Consequently, we don't see much difficulty in the development of architecture that incorporates the capabilities of PBN and network measurement to improve the performance of quality of service applications.

Back to top of page **Back to the sessions page**

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Dr. Jingsha He has been a Member of Research Staff with Fujitsu Laboratories of America, Inc. since August 1997 where he has developed an extensive research and product development and management experience in Internet quality of service, network measurement, traffic engineering and virtual private networking. Prior to his present employment with Fujitsu Labs, he worked for GRIC Communications, MCI WorldCom and IBM for more than ten years in research and product development and management in the areas of Internet global roaming, SS7 signaling, network management and computer and network security, and has published extensively in the above areas. Dr. He is also the primary inventor of a dozen U.S. patents on new Internet and telecommunications products and services. Dr. He received his Master's and Ph.D. degrees in computer engineering from the University of Maryland at College Park in 1984 and 1990, respectively, and his Bachelor's degree in computer science and engineering from Xi'an Jiaotong University in China in 1982.

Back to proceeding page   **Back to the sessions page**

☑ **Policy / Regulatory**

Wednesday, 17 January 2001
1030–1200

W.2.5 Commercial Launch Services Industry Panel

Location: South Pacific IV

Moderator:

ED WARD, Vice President, International Launch Services (ILS), *USA*

PTC2001 will reach beyond earth bound telecommunications and extend itself into space with wide participation by the communications satellite industry and the commercial satellite launch services industry as well.

The Commercial Launch Services Panel for PTC2001 will consist of executive level representatives of the largest commercial launch services providers in the world today and will be asked to address the issues faced by the satellite and launch industry for the coming year. The panel moderator will present the issues to each panel member and will direct questions from the PTC participants to the panel members.

The Commercial Launch Services Panel will represent Arianespace-Ariane (Europe), Boeing-Delta (USA), The China Great Wall Company-Long March (China), International Launch Services-Atlas and Proton (USA and Russia), Rocket Systems Company -The H-2A, (Japan) the Sea Launch Company-Sea Launch (USA and Ukraine).

$ **Economics & Financing**

Wednesday, 17 January 2001
1030–1200

W.2.6 Data Networking

Location: Honolulu Suite

Chair: JACK BORSTING, Executive Director, Center for Telecom Management & E. Morgan Stanley Professor of Business Administration, Marshall School of Business, University of Southern California, *USA*

W.2.6.1 Carriers Network Infrastructure in the New Millennium (ABSTRACT)
(moved from W.2.4.1)

GIHYOUKI LEE & WONHEE SULL, Platform R&D Center, SK Telecom, *Republic of Korea*

W.2.6.2 Access Network for Ubiquitous Broadband (ABSTRACT)

TOMOHIRO ISHIHARA, Manager; MASATO OKUDA; and JUN TANAKA, Fujitsu Laboratories Ltd., *Japan*

CARRIERS NETWORK INFRASTRUCTUREIN THE NEW MILLENNIUM

Gihyouk Lee and **Wonhee Sull**

Abstract

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I. Challenges that carriers face in the new millennium

The telecommunications industry now faces fiercer competition than ever in the converging network business environment. Carriers must provide cost-efficient and innovative services to consumers requiring carriers to modernize and bring the networks to high-speed so as to provide new services.

From the users' point of view, the Internet and data applications take up an important part of their business, education and daily lives. Data traffic volume is doubling each year in many countries and it will become the dominant traffic in the near future. In order to meet this market demand, therefore, carriers will need to not only provide new services, but to accumulate technology at a low cost [1].

Today's telecommunications network is categorized largely into TDM (Time Division Multiplexing) type of circuit switching network and packet switching network. While the circuit switching network provides services for voice services, the packet switching network supports data and multimedia services. These two types of networks have been built and operated separately (as illustrated in Figure 1), but some networks as in the case of SK Telecom have data and voice services possible on a tightly linked infrastructure.

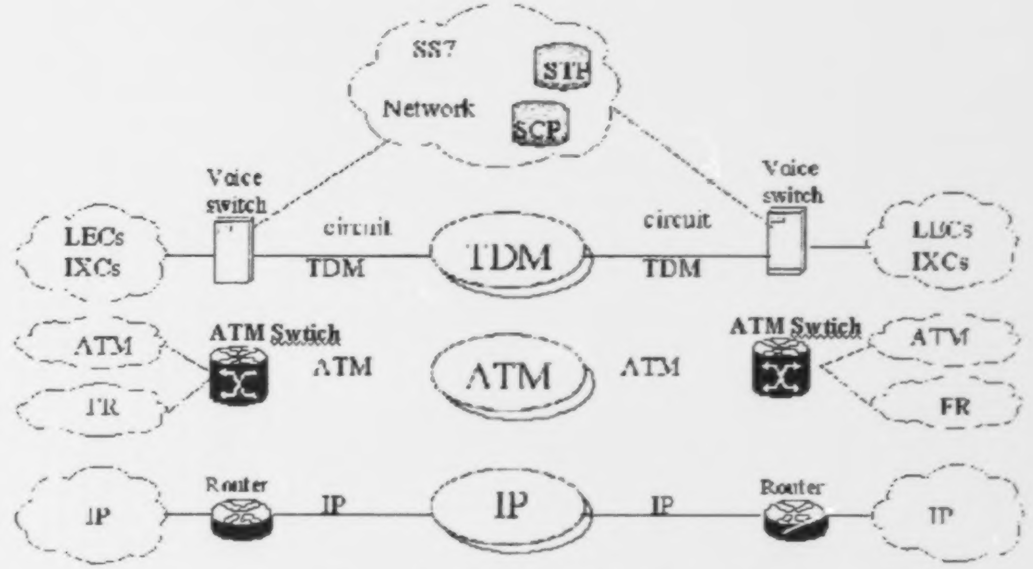

Figure 1. Existing Network Architecture

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However, the Circuit Switching network has been very effective in providing abundant portfolio to provide high quality voice service, directly linked to profit generation. Because such network structure is not the technology most adequate to provide the new data and multimedia services, the packet switching network technology is required to effectively control the large volume of data transmitted through the network. For this reason, telecommunication industries must resolve several key problems [2] [3].

First of all, the voice service market will not disappear, but will keep growing. In developing the packet network based on a variety of service structures that are economical and effective for voice and data, decision has to be made between the direct migration of the TDM network into the packet network and the development of a single packet network designed from scratch.

Secondly, in Korea, in particular, current packet networks have been built for a various purposes: to support ISP(Internet

Service Provider) business, the Frame Relay business or enterprise business operations. However, most of these networks are not to easily evolve to support extensive xDSL (ADSL, HDSL, SDSL, VDSL) service structure, ATM service, or the IP service. As a result, an upgraded and/or new data network needs to be developed to provide data services.

Finally, it is very costly to build an isolated network to be used for a specific task. Also, it is difficult for a network designed for a specific application to be used for a variety of integrated value-added services. Consequently, it is necessary to design an integrated network infrastructure for cost reduction and service integration.

II. A new integrated network with dispersed functions

In this section, we proposed a new integrated network with the motivations identified in the previous section. The new network model consists of a high performance packet switched backbone that is accessed by a variety of edge or gateway devices as in Figure 2. These edge devices provide the interface between the customer and the network, supporting protocol conversion and efficient concentration of network bandwidth.

The gateway devices provide the links between the PSTN(Public Switched Telephone Network) and the new packet network, ensuring services transparency and ubiquity. The network is controlled by servers or call engines with built-in intelligent software technology such as call access request and service provisioning.

Multiple servers may be required to work together to deliver a specific service to a customer. The industry standards for the compatibility between the server and components of other networks are being developed to accommodate various equipments and international standardization organizations are making preparations accordingly.

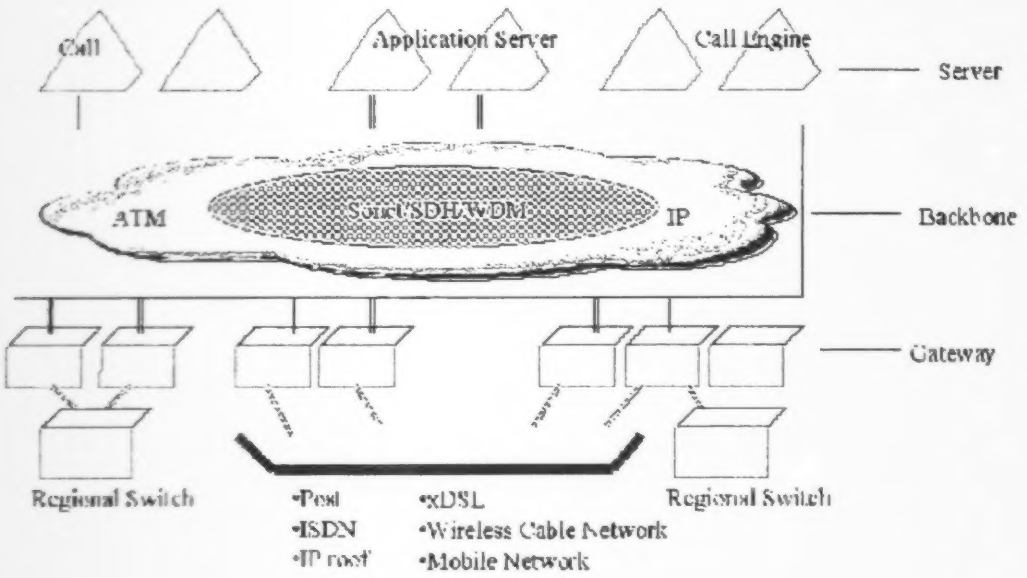

Figure 2. The Proposed Integrated Network Architecture.

Furthermore, efficiency is a key factor in the newly developed packet switching network. An industry standard is being developed based on the two basic packet technologies, ATM and IP.

ATM is a packet protocol which is already in use in numerous network and is applied to facilitate efficient voice and data service within one single network and it has the ability to provide high quality service. IP is a widely used protocol that supports most of the data within the network. Today, IP is still under development or only part of the service is available, but it will be able to provide high quality service in the near future. Most telecommunications companies, therefore, use both technologies - ATM for the core network and IP for terminals [5] [7] [8].

The most important characteristics of this new infrastructure is the dispersing of functions. In other words, service functions and applications functions can be divided through the packet switching network rather than centralizing the functions in a

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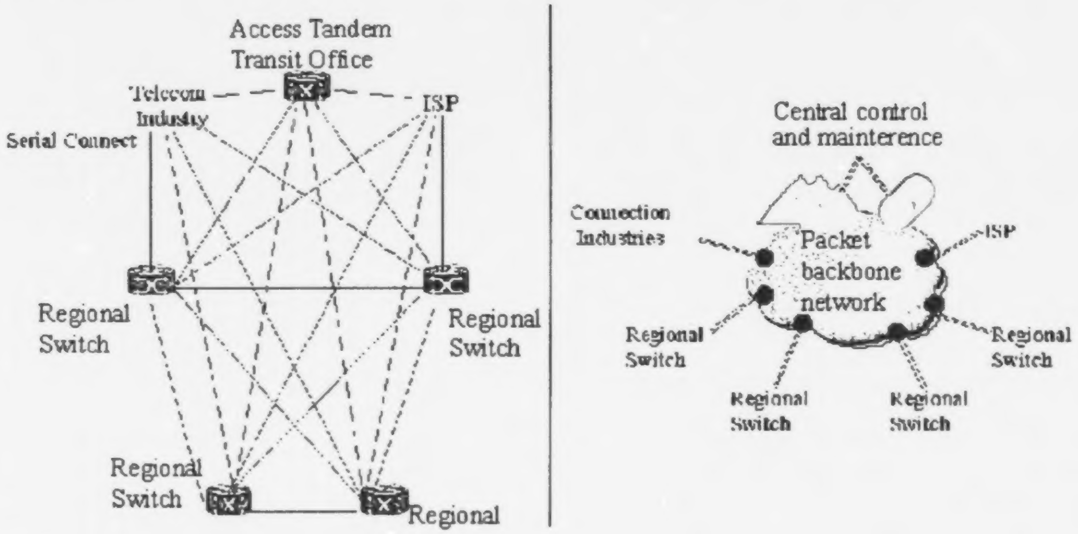
specific circuit switch. This allows better flexibility and optimization in designing the network and various positive benefits in terms of cost and service can be produced since network components can be located anywhere in the network.

II.1. Voice Solution for Telecommunications Companies

The new network of telecommunications companies, which helps solve today's voice and data call traffic issues, enables packet-based services. Such development of integrated network provides a foundation for building up competitive edge to service suppliers without network investment or service cost generation.

- The new network will replace the TDM-based voice network with the multi-service packet network without giving any ill side effect on the existing voice service. This solution will solve the Tandem Trunk exhaustion problem and replace the voice tandem (gateway) using the ATM core network [5].
- The tandem (gateway) connection is the first step to migrate from TDM voice trunk to ATM AAL2 for bandwidth accumulation of the core network which would have voice services available with VoATM or VoIP. It is a multi-service using ATM or IP core network [5] [7] [8].
- The way to connect IP is having telecommunications companies to build a new voice infrastructure in the IP network that has Off-The-Shelf call server structure. This solution provides voice and data service integrated in the IP structured network [7] [8].

The new network replaces the conventional node-based network with a packet-based dispersed network which is linked with the core network through a connection device. Figure 3 contrasts a typical today's voice network (a) and the target integrated network architecture (b).



(a) A typical voice network **(b) The integrated network**

Figure 3. Transitions from today's multi-vender investments into the integrated Network architecture

II.2. Solution for the Shortage of Connection Lines

The efficient application of network bandwidth may be a solution to the shortage of connection lines as witnessed in the recent network access difficulty due to the increasing Internet call traffic and voice and wireless traffic.

A simplified network reduces the overall network maintenance cost a great deal and can provide better and more diversified services and expanded traffic capacity with a more dispersed and less number of network components in the wide bank packet network. This innovative design can reduce operation cost by integrating layers, eliminating connection points between layers and reducing connection operation. Also, service suppliers can change the investment from the current TDM core network to wide bank infrastructure data centralized while protecting the existing voice revenue source [16].

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It is not necessary to modify the existing TDM equipment or redevelop software structure because the new network is distinguished from the new integrated packet network. The solution based on standardization has interoperability with all equipments of the supplier's ATM switching equipment. Therefore, the new network still supports today's useful services including call transaction pattern, data connecting and SS7(Signaling System 7) based services.

Also, a variety of services for new revenues is available. The multi-service network allows service suppliers to enter the market by building extensive service arena with various services in the network based on packet-based services.

Almost all equipment suppliers access the network using industry standard protocol which have interoperability with their TDM switching equipment, OSS(Operations Support Systems) system and ATM. Network components are required to follow industry standards of control organizations such as various network-related international forums, ITU (International Telecommunications Union), BELLCORE, ANSI (American National Standards Institute), and ETSI (European Telecommunications Standards Institute) [11] [12] [13].

The integrated network provides standard services to service suppliers using ATM/IP network with inherent QOS(Quality of service), low latency, and reliability benefits. This can ensure stability and quality required to provide sensitive services (99.999% efficiency, round-the-clock service).

The modular structure which allows cost efficiency and capacity enhancement maintains capacity variability and flexibility. It should be easily upgraded from small to large capacity.

II.3. Components for Constructing an Integrated Network

Today's TDM equipment continues to provide line-side telephone, enhancing return-on-investment for years to come and call servers provide important dispersing functionalities within the nodes such as call conversion which is linked to the integrated network and service logic [18].

The central controller provides conversion and relay control for the new network by eliminating the SVC (Switched Virtual Circuits) in the ATM network and constructing gateways. Call servers must be able to be composed of exchange offices which have Tandem/Transit office and software and processor upgrade.

Multi-service gateways (MGs) are linked to PSTN in connection with the regional relay network and to ATM network line. The termination point of this dispersion supports the connection with PSTN, TDM and ATM networks. The network connects with the ATM network using SVCs (Switched Virtual Circuit). The MGs should be independent intermediate gateway that can work and have interoperability with equipment suppliers' call servers using standard Media Gateway Control Protocol (MGCP).

The new network manager will be able to reduce network control cost by simplifying network control, operation and maintenance. Also, the new network manager will enter the market quickly with better quality of service, customer satisfaction and new services.

III. Development of the New Network

For service providers seeking solutions for Tandem shortage problem, new network solution should be developed for voice service first, then later, data network should be integrated within the multi-service network. As an alternative, multi-service and ATM switch used for data network can be developed at the terminal of network so as to collect voice traffic from MGs. Also, FR (Frame Relay), DSLAM (Digital Subscriber Line Access Multiplexer), IP and ATM will use the same network.

The new network solution is the optimal solution for using region- or nation-wide services due to its dispersed structure. In order to provide voice service in the packet network, CLEC (Competitive Local Exchange Carrier) and owners of facilities and equipment should make considerations for the switch equipment that allows integration with existing network solution.

III.1. Voice Gateway Solution

Among new switch equipment solutions, the packet network all server has a tandem locating functionality, which will replace the voice tandem layer. Switching equipments, on the other hand, should provide a unique gateway solution to transmit PSTN voice in packet core of ATM AAL2(ATM Adaptation Layer 2) or IP. Also, switch equipment should have interoperability with any call server of the equipment supplier based on standard protocol that is designed as official intermediate gateway [5] [8].

Due to the incomplete standardization of MGCP, switches should have a two-phase structure when constructing dispersed network structure. The first phase is the tandem connector solution and the second phase is the voice switch solution. The former has been successfully applied and is in operation in some telecommunications companies' networks and the latter is being tested by equipment suppliers.

III.2. Tandem Connect Solution

The voice gateway should be able to reduce the gap between T-1/T-3 trunk or leased tandem (doubles or triples the bandwidth margin which is supported by single DS 1 link) when an optimal ATM AAL-2 voice transport is applied to ATM (VTOA, Voice/Telephony over ATM).

A voice gateway solution is built to operate best in a multimedia ATM structure. It should be provided in the nodes such as Frame Relay (FR), IP, ATM and CLES(Company Local Exchange Carrier). Also, it is necessary to reinforce the transmission ability of ATM as well as voice transmission ability to PSTN network. CLEC which seeks expansion of voice service when voice exchange is not economical is becoming an attractive solution. Constructing a voice gateway within CLEC POP(Point of Presence) as a back up to the voice service in the central exchange site is one of many effective ways to rapidly expand CLEC service area [14] [16].

Tandem connect solution provides point to point connection in the packet network and the first phase is to support voice communication on packet. The next phase is linking with the call server using standards for supporting exchange voice services. Figures 4 illustrates the voice gateway used as PSTN voice transport.

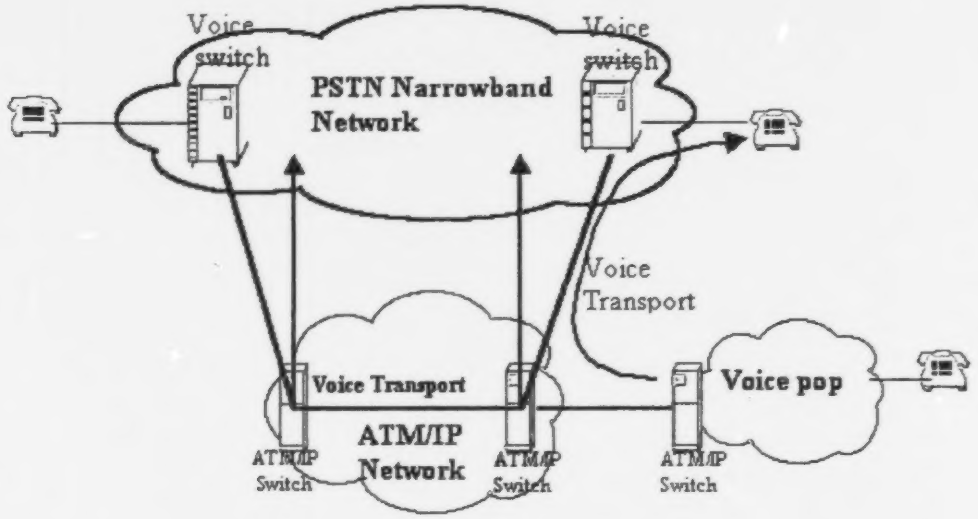

Figure 4. Voice Gateway used as PSTN voice transport

III.3. Switched Voice Solution

The switched voice solution provides continuity in packet system. A signal handling gateway connects the SS7 signal network using standard protocols such as IPS7 or ISUP+(ISDN user part) and then handles the MTP(Multi Transfer Processign) protocol by sending an ISUP+ message to intermediary gateways such as STP (Signaling Transfer Point).

A call server/intermediary gateway controller completes SS7 signal handling, supports the continuity in the core packet network using MGCP and performs exchanges, conversion and account functions.

The intermediary gateway performs connection setup and disconnection functions within a network. In addition, it compresses voice, removes mute and echoed sound, handles RTP/UDP/IP(Routing Transfer protocol / User Data Protocol / Internet Protocol) and manages voice including ATM and IP functions.

A voice gateway that plays an intermediary role interlocks with IP connection engine which is controlled by SGCP(Simple Gateway Control Protocol) for IP services and voice exchanges. It should interlock with a succession call server in addition to MGCP once it is standardized [16].

The voice gateway is popular among wireless service providers because it can be used as a core network between sites. It allows wireless traffic to detour a service provider's long distance network and local PSTN in order to reduce costs, and UMTS

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(Unified Message Transfer System) capable of transmitting data controlled by AAL5 and voice controlled by AAL2 is easily applied to it.

Figure 5 illustrates switched voice network solution.

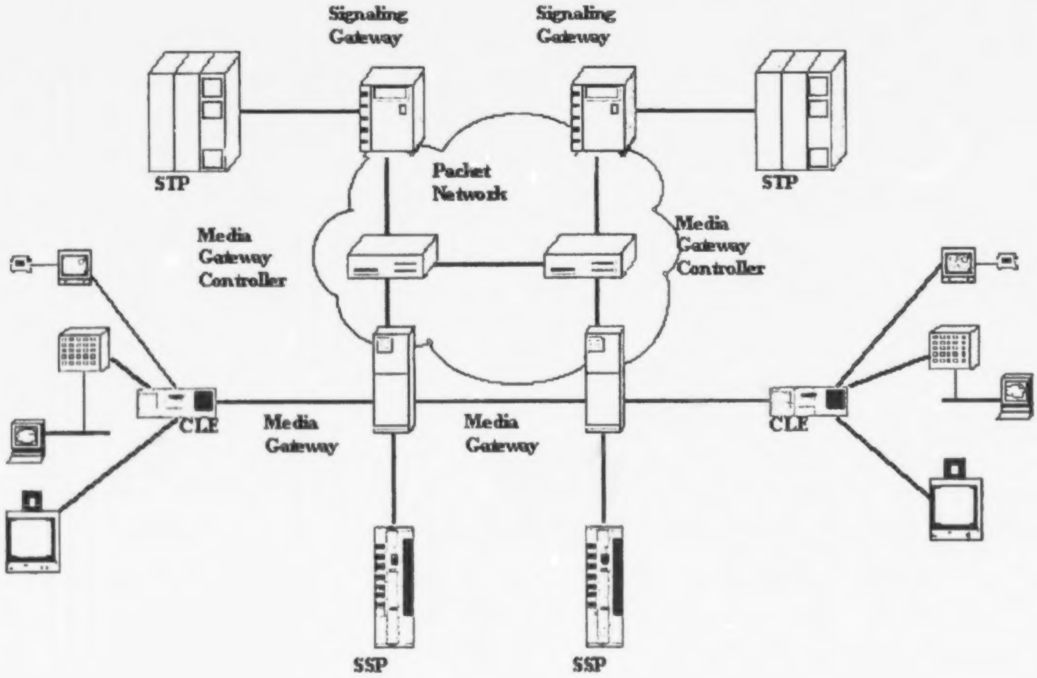

Figure 5. Switched Voice Network Solution

III.4. IP Connect Solution

All IP is often referred to as the next generation telecommunications network. This network is built with a large-scale Packet network as a basis and it is proposed as a solution provided that all existing networks are incorporated. Such Packet network provides a voice access functionality which uses the ISP (Internet Service Provider) based on the Internet Protocol and IP, a new area of the IP Telephony for voice telecommunications companies.

With IP connection to IP network capable of providing efficient, innovative and various services, telecommunications service providers can provide services for Voice over IP (VoIP) and Fax over IP(FOIP) which has reliability in data and voice in various forms [14] [15] [16].

IP connect solution has an advantage of composing a profitable tool for the IP business telephony in an indirect way. Also, the solution can provide a more advanced service such as call center application, call handling card, and interactive voice response in addition to improved call handling services such as call waiting and call transmission services.

Furthermore, telecommunications companies will be able to provide higher quality of application services such as global Centrex, unified message processing, global roaming and multimedia conference system which are not available in the PSTN and which are unique to IP network.

IP Connect is an end-to-end solution that must include call control, high quality application server, gateway between PSTN and SS7 network, customer accommodating equipment and it must be incorporated with various protocol connection strategies.

Figure 6 as seen below is a component of the new network of telecommunications companies. The new network is composed based on the Packet network. It incorporates the existing voice communications network, data communications network, and mobile phone related networks. The figure illustrates a summary of the telecommunications infrastructure needed by next generation telecommunications companies.

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Special attention was given to the link among the following three components: IP Connect call engine needed for linking the voice communications network, the IP-SS7 Gateway to control the call engine and the 3 G (3 Generation) needed for providing high speed data service on the move.

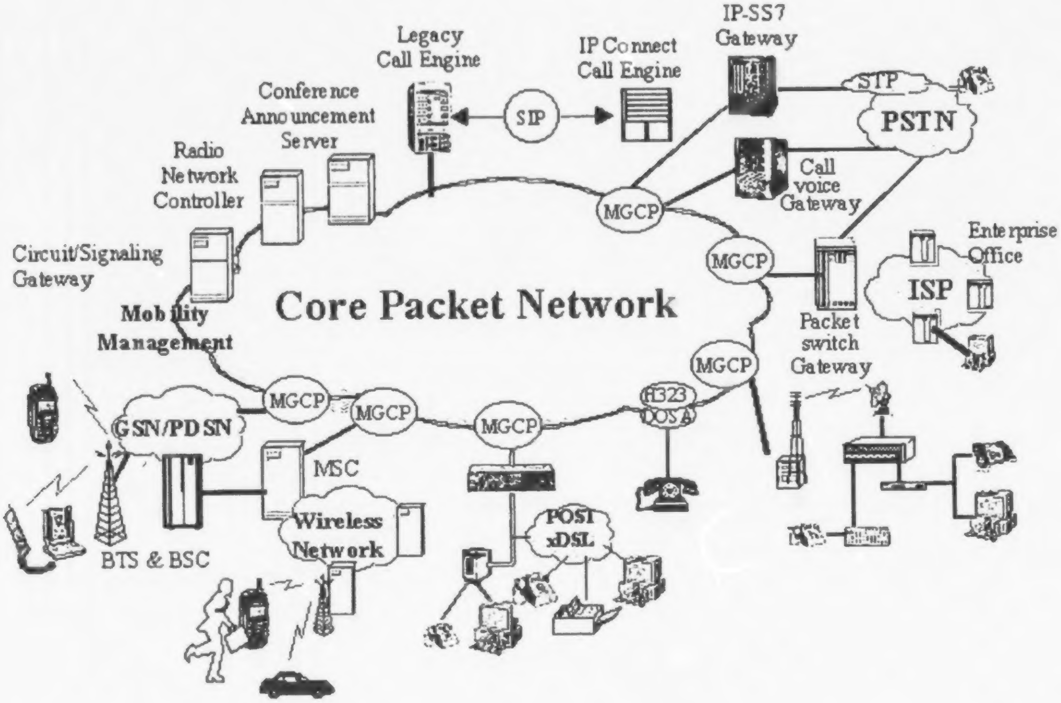
IP-SS7 Gateway
Legacy Call Engine
IP Connect Call Engine
SIP
STP
PSTN
Conference Announcement Server
Radio Network Controller
Call voice Gateway
MGCP
Enterprise Office
ISP
Circuit/Signaling Gateway
Core Packet Network
Mobility Management
Packet switch Gateway
GSN/PDSN
MGCP
MGCP
MGCP
H323 DOSA
MGCP
MSC
Wireless Network
POST xDSL
BTS & BSC

Figure 6. The New Network Connect Overview

The media gateway equipment plays the bridging role between different network types. The voice gateway is an ideal multi-service connection exchange device used for high quality, large scale IP based long distance network. This device has interoperability in a network with different gateway methods.

The media gateway call control equipment is an important device required for the IP connect solution. This equipment provides the call handling capability required to complete a variety of call types going through the IP network such as first step dialing, N00 call, PIN certified multiple step call and operator supported calls.

The IP Connect signaling gateway(IPCSG) provides secure and reliable access points to the SS7 network. IPCSG is the termination point of the MTP(Message Transfer Part) layer and links route ISUP(ISDN user part) to the appropriate Media Gateway. It may be augmented with capabilities in the future to provide geographic switch over capability not available with typical PSTN installations [17] [18] [19].

I. Conclusion

Service providers nowadays must be able to maintain the existing voice revenue sources while building or upgrading their infrastructure to develop new services. At the same time, they should be able to fulfill various demands from customers.

To achieve this, service providers must first enable the migration from today's rich PSTN voice infrastructure to multi-service packet networks. During this migration, it will be possible to construct multi-service access service such as xDSL by utilizing the multi-service packet infrastructure at the edge.

The new integrated network must be built to provide voice and multi-service functionalities using the multi-service packet infrastructure. The WAN switch gateway widely used today by service providers is used to accumulate bandwidth for the remaining infrastructure network facilities by controlling ATM AAL2 or providing voice relay using IP.

The voice gateway structure will carry out voice exchange functions in the dispersed network at a later time or it can be

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developed as an intermediate gateway that is linked to the intermediate gateway controller supporting MGCP standards.

The IP connect solution enables service providers to deliver voice services to customers using the existing TDM equipment. This solution focuses on delivering integrated voice and data services while supporting legacy service through this link. This solution is an adequate solution for carriers in building new IP focused network while providing voice services.

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Back to top of page Back to the sessions page

Abstract

In the new millennium, data traffic volume is expected to surpass that of voice traffic in the public network. To meet the needs of the rapidly growing internet-based services, carriers need to ensure that their network infrastructures accommodate heavy volume of data traffic in the near future. At the same time, voice services today still account for more than 80% revenues of full service provider's revenue stream. Therefore, service providers are also looking into various ways of enhancing their revenue stream by offering high profit margin services. To meet the carriers needs in building data service enabling networks while offering voice services with cost reduction in mind, this paper presents different alternatives for existing and new carriers to build and/or evolve their network infrastructure.

Go to proceeding page Back to the sessions page

Access Network for Ubiquitous Broadband

Tomohiro Ishihara, Masato Okuda, Jun Tanaka

Abstract

1. Introduction

Just only several years ago, the advent of the World Wide Web (WWW) triggered the explosion of Internet population and traffic. Before the explosion, the Internet was one of the research topics for academic experts. The WWW and the start of commercial Internet services have led the growth of population who use the Internet for fun. Nowadays, the Internet is increasing its importance as a key social infrastructure for the next decade, because it's a platform for network-based new businesses such as electric commerce (EC) and Internet-based data centers (IDC). This rapid change is also forcing telecommunication systems, which have been built for mainly telephone services, to converge on IP (Internet Protocol)-based traffic and services.

Figure 1 shows the most up-to-date network model for IP-based services. The key elements of this model are the Internet, the ISPs (Internet Service Providers), the data centers, and the access networks that focused on in this paper. In this model, two types of users are assumed, who are residential and business users. The residential users are connected to the Internet via the access and the ISP's network. The most of them take network services including e-mail and web browsing for their private needs. On the other hand, business users, who are connected to not only the Internet but also the data centers, operate their business utilizing network-based services including EC and server-based outsourcing. The network and its services have become an indispensable business infrastructure.

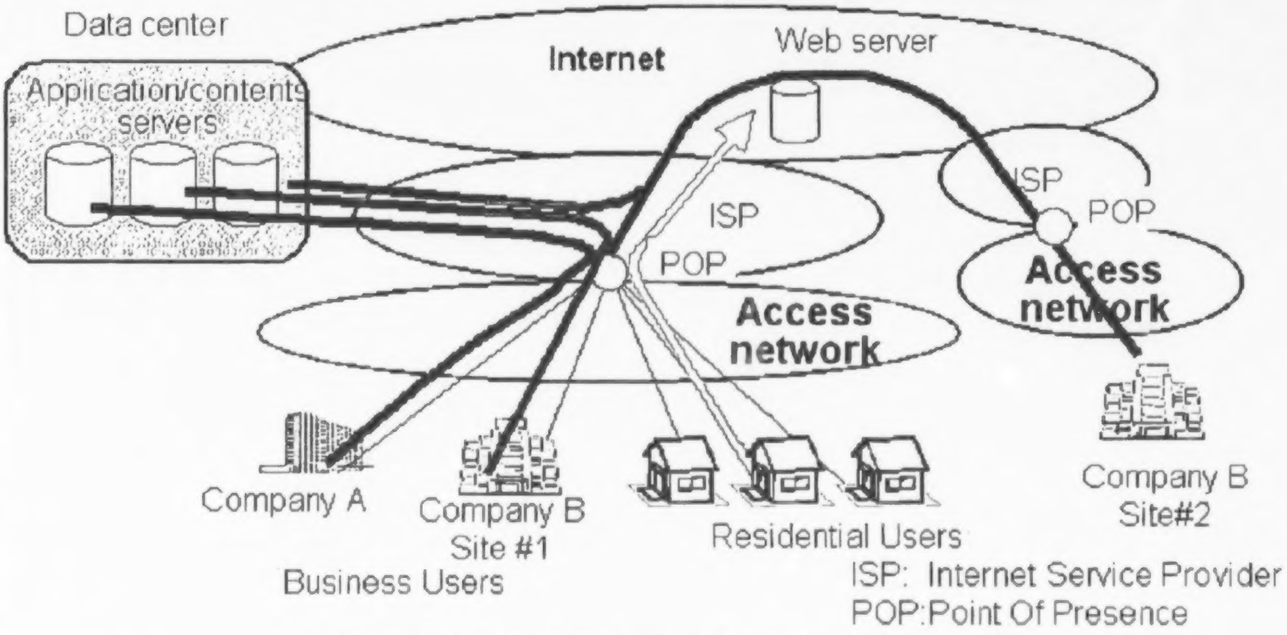


Figure 1. Modern network and service model

This situation has changed the requirements for IP networks, which is now not the former Internet. The Internet originally provided just narrowband, best-effort and non-secured packet transfer services. It was acceptable for personal and fun use. But for the business use, richer capabilities such as broader bandwidth, guaranteed quality, reliability and security are now essential requirements.

Taking account of the modern networks and the service models described above, we clarify the requirements for new access networks that link end users and service providers up.

- Provision of broadband access

Considering network environment in end user sides, the rapid development of Fast and Gigabit Ethernets has established high-speed LANs (Local Area Networks) in offices and even homes at low cost. On the other hand, WDM (Wavelength Division Multiplex) technologies have been successfully applied to backbone networks then achieved enormous growth of network bandwidth. On the contrary, access networks which connect end-user's LANs and backbone networks still remain bottle-necks from the viewpoint of the bandwidth. The most essential requirement is provision of mega-bit-per-second-class access services at lower cost.

- Provision of multiple grades of service quality

As mentioned previously, the web browsing for fun is satisfied with best-effort service quality at the lowest cost. On the other hand, business users require guaranteed service quality as well as best-effort one, because they operate their business, maybe including mission critical ones on the network. Therefore, access networks should provide the wide range of quality of services (QoSs) in terms of bandwidth, loss ratio and delay to fulfill all demands of various users.

- High reliability

The business users rely on the networks as an infrastructure. A network malfunction will cause serious problem onto their businesses such as suspension of the production or loosing big business chances. To achieve high reliability, access networks should have some mechanisms such as redundant network resources and automatic protection switching.

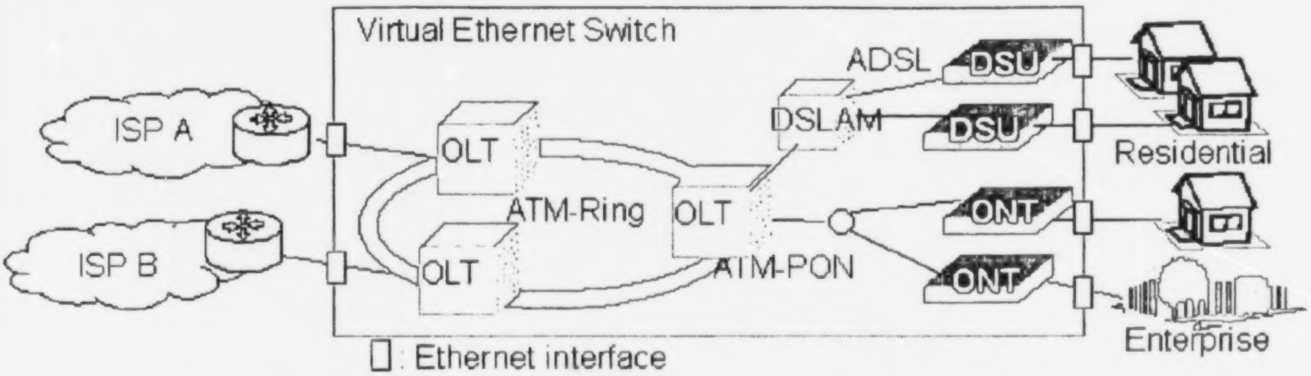
- Security

As shown in the figure 1, the some companies use the same networks. Even on this condition, user's data must keep away from tapping or disturbance. From the viewpoint of access networks, the virtual connections for each user (e.g. between the data center and offices) must securely coexist.

In this paper, we first describe the architecture of our proposing broadband access network . Secondly, subscriber line technologies are discussed. Then an ATM ring and multiple QoS switching technologies are described. Finally, the conclusion is remarked.

2. Broadband Access Network Architecture

Figure 2 shows our proposing broadband access network. It provides network-wide Ethernet connectivity, say "Virtual Ethernet Switch". It provides the Ethernet interface to each end-user, and transports IP packets between the interfaces using very reliable and secured scheme, here ATM.



ISP: Internet Service Provider
ADSL: Asymmetric Digital Subscriber Line
DSLAM: Digital Subscriber Line Access Multiplexer
DSU: Digital Subscriber Unit
ATM: Asynchronous Transfer Mode
PON: Passive Optical Network
OLT: Optical Line Terminator
ONT: Optical Network Terminator

Figure 2. Our proposing broadband access network architecture

The key component of the network is the OLT (Optical Line Termination). The OLTs compose an access ring network to rake traffic together from users within a certain area (e.g. a city or town). Both residential and business users can obtain broadband service of multi-Mega-bit-per-second by APON (Asynchronous Transfer Mode Passive Optical Network)[1] or ADSL (Asynchronous Digital Subscriber Line)[2] technologies.

We chose the ATM (Asynchronous Transfer Mode) as the base technology for access networks. Because both ADSL and APON are based on the ATM technology, and the OLTs can transparently transfer those ATM cell streams from/to subscriber lines via the ring. In addition, the ATM can provide the multiple QoSs[3]. This is the key nature of the ATM comparing to other packet-based technologies (e.g. IP or Ethernet). The ATM Forum has defined several service categories corresponding to QoS. For example, CBR (Constant Bit Rate) is applied to a connection with guaranteed bandwidth, the lowest loss ratio and the lowest latency. On the other hand, UBR (Unspecified Bit Rate) is generally used for the best effort service that guarantees nothing. This multi-QoS capability can cover various demands of various users in the access network.

Ring networks has been used in conjunction with SONET (Synchronous Optical Network)/ SDH (Synchronous Digital Hierarchy) technologies all over the world. One of the advantages of the SONET/SDH ring is its high reliability achieved by automatic protection function such as UPSR (Unidirectional Path Switched Ring) and BLSR (Bidirectional Line Switched Ring). SONET/SDH rings have two types of paths, work and protection paths. In the event of failure, the traffic is switched from the work to the protection, then the services are preserved. Our proposing ATM ring also takes this mechanism to improve reliability. We'll also describe another benefit of the ATM ring in the section 4.

The access network based on the ATM can convey each user's IP traffic separately using ATM VP/VC (Virtual Path/Virtual Channel) connections because the ATM is a layer 2 protocol and independent from layer 3 protocols (i.e. IP). This feature results in high-secured networks.

Although the ATM meet the requirements of the access network, end user prefer the Ethernet rather then ATM interface because it's widely deployed in offices and homes. So, DSUs (Digital Subscriber Units) of the ADSL and ONTs(Optical Network Terminations) of the APON should provide the Ethernet interface as a UNI (User Network Interface), then these equipment must have ATM-Ethernet interworking functions. So, the access network connecting between Ethernet interfaces performs like the virtual Ethernet switch to achieve reliable Ethernet connectivity.

3. Transmission Technologies for Subscriber Lines

The ADSL has been internationally standardized and widely installed to provide broadband services. The reason why the ADSL is now attracting a great deal of public attention is that it achieves higher service bit-rate than dial-up modems with relatively low installation-cost by re-using existing copper-wire plants. However, the ADSL does not fulfill the all needs for broadband access because of its limitation on transmission distance and maximum bit rate, and noise sensitivity.

To complement the copper access, optical fiber access using the PON technology is now gaining its importance. The APON technology has been standardized by the ITU-T (International Telecommunication Union - Telecommunication Sector), and widely installed to provide practical services by the FSAN (Full Service Access Network) operators. The advantages of the APON compared to the ADSL are longer available distance, broader bandwidth, and electric-noise-proof. Also the APON has solved the cost issue on the fiber access by sharing optics and bandwidth between multiple users.

As shown in the figure 3, the ADSL and the APON have different application fields. For short-distance and mid-bit-rate needs, the ADSL shows its advantage in its cost. But longer-distance and broader bandwidth needs, the APON shows its advantage. Therefore, we believe the ADSL and the APON complement each other.

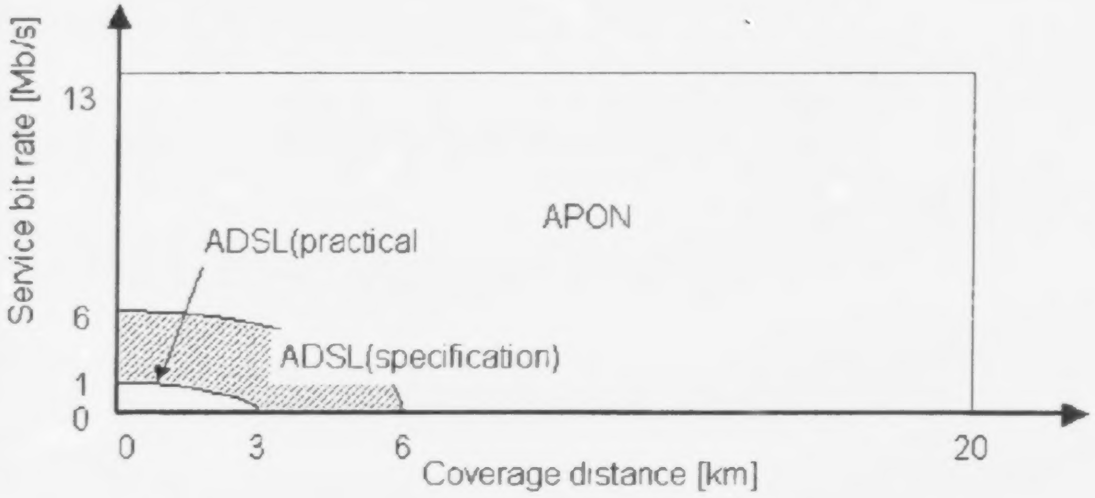


Figure 3. Application domains for ADSL and APON

As the result of above consideration, we take both the ADSL and APON as transmission technologies for subscriber lines in our access system.

4. ATM ring

Building an access ring with ATM-ADMs [4] and BLSR (Bi-directional Line Switched Ring) protection technique results in efficient use of network resources and reliable connectivity.

For the protection of guaranteed traffic such as CBR (Constant Bit Rate) and traffic less than MCR (Minimum Cell Rate) in GFR (Guaranteed Frame Rate)[3], the guaranteed bandwidth shall be less than 50% of link. The residual bandwidth can be allocated for UBR (Unspecified Bit Rate) and the traffic exceeding MCR of GFR when there is no loop-back as shown in the figure 4(a). Once a link failure occurs and each VC should be loop-backed, the bandwidth used by best effort traffic shall be overridden by loop-backed guaranteed traffic. That means a nature of best effort and provides efficient resource utilization in the normal and the loop-backed state. In addition, the ATM ring can maintain connectivity of best effort connections in the case of a link failure.

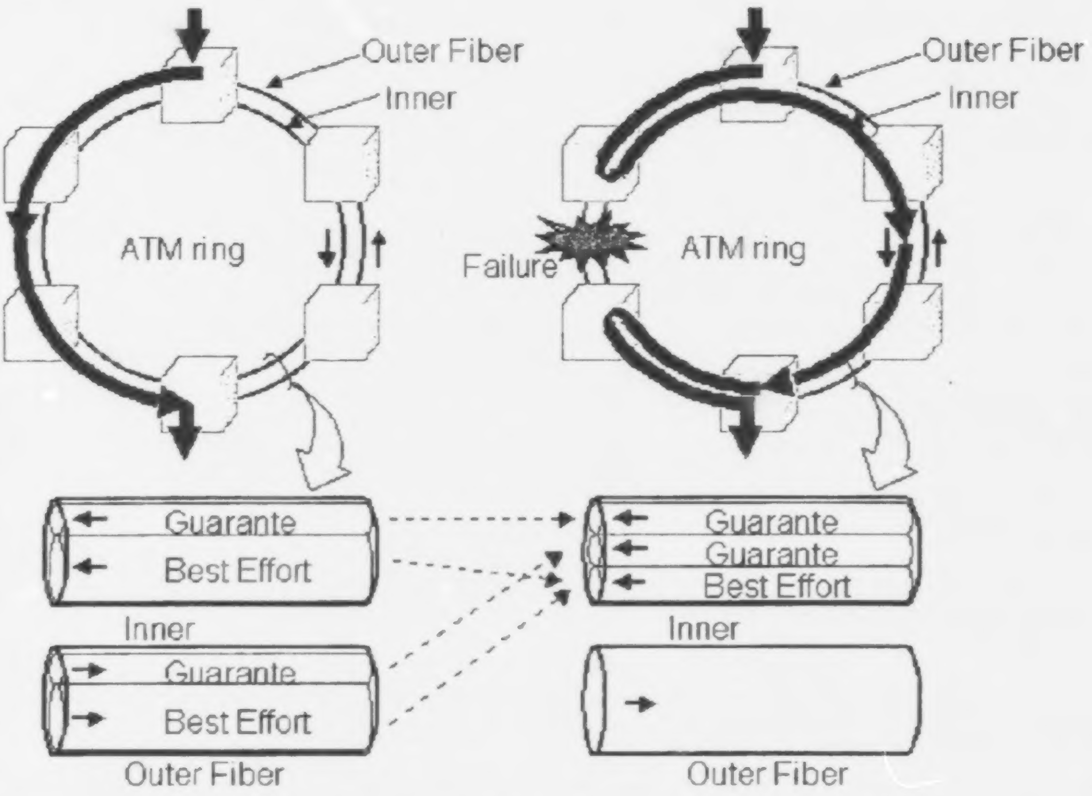


Figure 4. Redundancy and Reliable Connectivity of ATM ring

An existing SONET ring has the similar function. It can protect guaranteed bandwidth with loop-back function and provide "extra service". The extra service may be used for a kind of the best effort service on the protection path in normal operation. However, once a link failure occurs, connections of the extra service should be terminated because the protection path should be used as the loop-backed path. This feature can be fatal to recent Internet applications.

5. Multi-QoS

Although the access network can handle the multiple QoS classes of ATM, the IP QoS should be considered because major traffic is now IP-based packet flows. The IETF (Internet Engineering Task Force) has defined two methods for provision of multiple QoSs for IP-based services; they are IntServ (Integrated Service)[5] and DiffServ (Differentiated Service)[6]. Generally speaking, the IntServ is difficult to apply onto large-scale networks, but the DiffServ is not. Because we're assuming some order of large-scale for public access networks, the DiffServ is investigated as a principal IP-QoS mechanism for our ATM-based access network.

The DiffServ provides two categories of QoS, EF (Expedited Forwarding) and AF (Assured Forwarding). The EF classes may be used for "guaranteed service". It's easy to provide this service over an ATM network by mapping it onto the CBR of the ATM service class. On the other hand, the AF class is usually divided into sub-classes, for instance the sub-classes will be "gold", "silver", "bronze" and "best-effort". The difference of these sub-classes is their priorities for packet forwarding especially in congested state. However ATM originally cannot meet this criterion. In order to provide the AF over the ATM, we introduced the prioritized UBR class into our system. The AF sub-classes are mapped onto the sub-classes of the prioritized UBR class respectively.

Figure 5 shows how our system achieves the multi-QoSs including the ATM's and IP's.

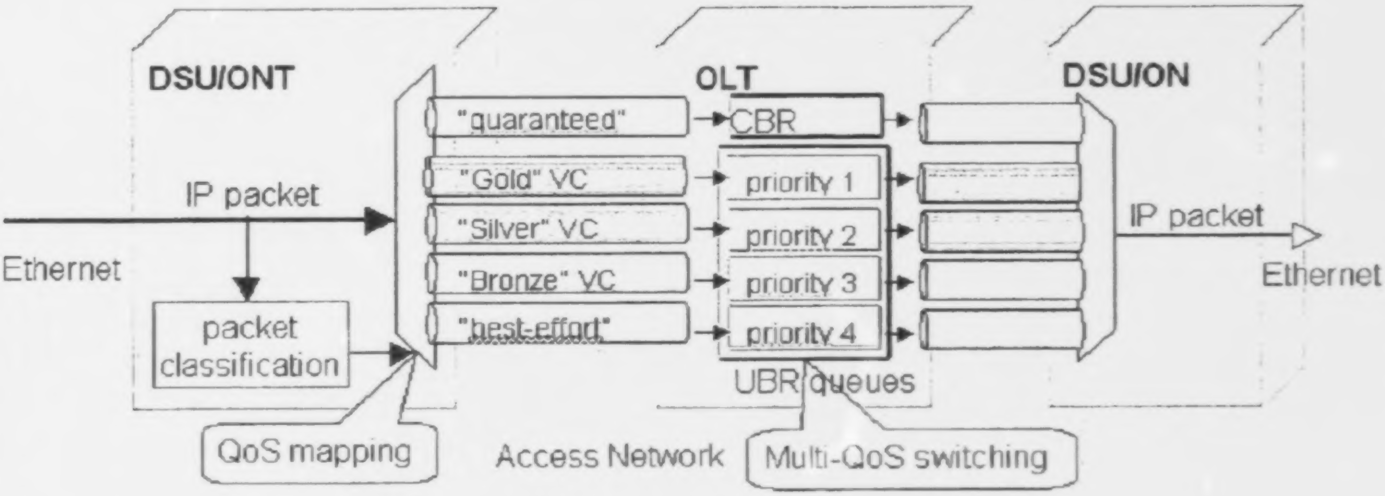


Figure 5. Multi-QoS support

The DSU or ONT in end user sites connects user's terminals or routers to the access network via an Ethernet interface. Also it maps the IP QoS to the ATM QoS. Each IP packet comes to the DSU or ONT, then is classified into an appropriate QoS class based on a certain classification policy. The policy may be a classification rule to distinguish packet's QoS using packet header information including source and destination IP addresses, TOS (Type of Service) field, protocol type and port numbers. A classified packet is sent to an ATM connection according to its QoS class.

The OLT itself has a switching function which is capable of multiple QoSs. The switch fabric in the OLT has five individual queues to provide both ATM and IP QoS. The CBR queue has the highest priority and cells in it are read out in prior to UBR queues. Cells in UBR queues are read-out in the order of their priority in the case of no cell in CBR queue. Utilizing the classifier in the DSU/ONT and the QoS-capable switch fabric in the OLT, our proposed access system provides multiple QoSs.

6. Conclusion

We summarized the requirements for new access networks for the next decade where IP networks become one of the social infrastructures. To offer benefits of IP networks and services to all people and businesses who want them, the access networks need to fulfill the requirements including not only broad bandwidth but also multi-QoS capability, high reliability and security.

Taking account of these requirements, we showed the architecture of the ATM-base access network. In the proposed network, the APON and the ADSL provide broadband connectivity to end-users. The ATM ring achieves high efficiency and reliability. The two key elements, the packet classifier on the edge of access network and the QoS capable switch fabric in the OLT, achieve multiple QoS capability for both IP and ATM services.

We believe that our proposing access network architecture meets the demands for the next generation network infrastructure and it makes "ubiquitous broadband" come true.

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Back to top of page **Back to the sessions page**

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He has received B.E. and M.E. degrees from Waseda University, Tokyo, Japan in 1991 and 1993 respectively. He joined Fujitsu Laboratories Ltd. in 1993. Since then he has been engaged in researches on broadband access systems, especially on ATM traffic management. From 1998 to 1999, he was a visiting researcher in the Stanford University, California, USA. His current research area is broadband access network including ATM and IP technologies.

Back to proceeding page   Back to the sessions page

Tomohiro Ishihara

He has received B.E. and M.E. degrees from Waseda University, Tokyo, Japan in 1983 and 1985 respectively. He joined Fujitsu Laboratories Ltd. in 1985. Since then he has been engaged in researches on high-speed transmission systems and broadband access systems. From 1992 to 1993, he was a visiting researcher in University of California at Berkeley. His current research area is broadband access network including ATM and IP technologies.

Back to proceeding page **Back to the sessions page**

The session will discuss the issues that were raised during PTC2001 and build upon the theme of the conference - From Convergence To Emergence - Will the User Rule?

With a diverse PTC audience of international interest groups, the session is intended to be an interactive discussion from the perspectives of the carrier, government, business and average user.

Chair:

WINSTON. THOMPSON, Chief Executive Officer, Telecom Fiji Limited, *Fiji*

PTC Mid Year Preview
NAM JIN CHO, PTC Korea Chapter, *People's Republic of Korea*

Carrier Perspective
TADASHI NISHIMOTO Vice Chairman, KDDI, *Japan*
The Role of a Network Operator in the Future of Internet and Mobile Communication

Government Perspective
KOICHI UCHIDA, Director-General of International Affairs Department Telecommunications Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT)

Major Users' Perspective
HONORABLE WARWICK SMITH, Executive Director, Macquarie Bank, *Australia*

Individual User Perspective
GREGG DAFFNER, Chief Strategic Officer, q-east broadband, *USA*

Plenaries

Monday 15 January 2001– Plenary Sessions

0830–1030

Plenary Session

(Webcast, sponsored by Compaq)

Location: Tapa Ballroom

Moderator:

DIANA SHARPE. Chairman, International Telecommunications Users Group, *United Kingdom*

Speaker:

Dr. JUNG-UCK SEO, Minister of Science & Technology, *People's Republic of Korea*
Toward the Global Information Society - Opportunities and Challeges

Panelists:

ROBERTO BLOIS, Deputy Secretary General, International Telecommunication Union

MARIA LIVANOS CATTAUI, Secretary General, International Chamber of Commerce

MIKE ROBERTS, President & CEO, The Internet Corporation of Assigned Names & Numbers (ICANN)

1600–1730

Plenary Session

(Webcast, sponsored by Compaq)

Location: Tapa II

Introduced by:

Governor Benjamin Cayetano, State of Hawaii, *USA*

Speaker:

NOBUYUKI IDEI, Chairman & CEO, Sony Corporation, *Japan*
Power Point Presentation

Wednesday 17 January 2001– Plenary Sessions

1400–1600

PTC2001 Closing Plenary

(Webcast, sponsored by Compaq)

Wednesday, 17 January 2001

Tapa Room

THE VIEW AHEAD
THE ROLE OF GOVERNMENT, INDUSTRY AND USERS IN THE INTERNET'S FUTURE

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THE VIEW AHEAD
THE ROLE OF GOVERNMENT, INDUSTRY AND USERS IN THE INTERNET'S FUTURE

Toward the Global Information Society Opportunities and Challenges

Dr. Jung Uck Seo

Minister of Science and Technology, Republic of Korea

Greetings

Ladies and gentlemen:

I am greatly honored and pleased to take part in this PTC-2001 conference and to have an opportunity to discuss with you the opportunities and challenges we face in moving toward the global information society.

To begin with, I would like to thank the PTC for inviting me to address this distinguished conference, and I salute the PTC for its commitment and contributions to the development of telecommunications in the Asia-Pacific region.

We are in the midst of unprecedented changes now taking place, changes triggered by the information revolution. This revolution will be the most important milestones in all of the history of humankind, along with the agricultural revolution and the industrial revolution.

The information revolution has brought about sweeping changes in the landscape of the world today. The changes are not only swift, but also broad and profound.

The Information Revolution: Current Impacts and Future Prospects

Ladies and gentlemen:

The increasing utilization of information technology is transforming international economic and social relations and presenting the world with new opportunities in various areas of human activities. Information technology is bringing the world closer together, and leading the way to the globalization of human activities. Information technology accelerates advances in bio-technology, nano-technology and others, and transforms the traditional industries into knowledge-based ones.

New jobs, an explosion of entrepreneurship, easier access to education, new modes of community building, and increased access to the global market, all of these changes are the dividends of this revolution.

The information revolution contributes to human development by enhancing material welfare. Information is the new enabler and a catalytic resource in the knowledge-based society that we live in, just as labor and capital were during the industrial age. Now, it is information that drives economic growth.

Think of the multi-billion dollar industries that have emerged from the creation, processing and accessing of databases. The information and telecommunications sector now accounts for 15% of the global trade, and explains about 25% of the growth in the OECD countries. Electronic commerce amounted to 26 billion dollars in 1998, but is anticipated to rise to a trillion dollars within a few years. According to a recent estimate, the economic activities flowing directly and indirectly from the digital economy will eventually account for half of the output in the industrialized world.[1]

Information and telecommunications technologies have reduced costs and increased productivities. Satellites, digital systems and optical fibers mean not just low cost but the capacity to offer new services and improve overall quality. Productivity in virtually every sector is enhanced by telecommunications and rapidly changing information technologies. Alan Greenspan said that the drastic improvement in computing power and telecommunications and information technology have been major forces behind the recent economic development trend.

The information revolution also enhances the political welfare of our human society. Contrary to George Orwell's prediction that information technologies will augment the power of the state and lead to a massive centralization of power, digitalization has empowered people, not the government, in their social and political activities in ways that would have been hard to imagine some years ago. For instance, the Internet is empowering millions of people by providing them information, the element on which civilizations have risen and fallen since the beginning of time. Indeed, the Internet acts as the great equalizer and can lead us to a more equitable, democratic and inclusive society.

Perhaps what the Internet is most fundamentally and favorably changing is education. It used to be that we went to school, then to college, maybe even to graduate school, and then went off to work for the rest of our lives. We even talked about "completing" our education. But, not any more. Those days are over. The information revolution has made education or learning a never-ending process; otherwise, you will fall behind or fall out. The Internet has made life-long learning possible through distance education, the digital library and easy access to educational materials.

But that is not all. Imagine the socio-cultural impact brought about in an isolated village with the installation of the first telephone line. Then, go a little farther and imagine the socioeconomic effects of a village telephone connected via satellite relay and small-scale earth stations to the thousands of international databases and to the hundreds of millions of telephone subscribers throughout the world.

What is more surprising is the rapidity with which these changes are taking place. The information revolution is proceeding at an unbelievable pace: in every 24 hours, 2 million new Web pages, 196 thousand new Internet-access devices and 147 thousand new Web users are added. By the year 2002, it is expected that there will be more Web pages than people on the Earth.[2]

Many anticipate if this pace is maintained, it will take only thirty years for the global diffusion of the information revolution, while it took more than 5 thousand years for the agricultural revolution and 2 hundred years for the industrial revolution. But, with regard to where this revolution is taking us, Bill Gates said that this revolution has just begun and it is hard to tell where the revolution will lead us.

Challenges to the Global Information Society

Ladies and gentlemen:

The information revolution is promising and is delivering various new opportunities, but it also presents many challenges as well. If we are going to harness the opportunities offered by this new revolution and direct them toward the betterment of our human society, we should understand and assess the information revolution from a broader human perspective. I believe we all can agree that our interests will be best served when the information revolution facilitates and promotes human development. But, that does not happen automatically. We should meet the challenges and work together toward building a global information society that brings all of us new prosperity, new literacy, new freedoms, democracy and a new sense of community.

I now would like discuss the key issues that I think challenge us on the way to achieving the global information society. The first and foremost challenge ahead of us is the digital divide. The information revolution may lead to serious imbalance and instability in our global village by widening the gaps that already exist between the rich and poor.

Let's first take a quick look at where our world is today. We live in a world of 6 billion people. According to the World Bank, 1.2 billion live on less than one dollar a day; 1.2 billion do not have access to clean water; 3 billion do not have access to sanitation; 2 billion do not have access to electric power; 70% of the world's population cannot read; 50% live in sub-standard housing; only one percent go to college; and less than one percent have access to the Internet.[3]

The information infrastructure is not ubiquitous. Today, there are more computers and telephones in the city of Seoul or Tokyo than in all of Africa. Developing countries, which account for 70% of the world's population, have only seven percent of the world's telephones. Of the 67 million computers in the world today nearly 90% are in the developed countries. Today, 80% of all telephone calls or data transmissions either originate or destinate in the United States. Of the nearly 700 million telephones in the world telecommunications network, three quarters of them are concentrated in the eight most industrialized countries. Where are most of the world's databases? US producers and vendors alone account for more than half of them.[4]

These inequalities among the world's nations are deepening the digital or information divide, which is one of the foremost issues of our time. The widening gap in digital capacity raises a serious concern that poor countries may not be able to overcome the financial and technical obstacles that limit their access to the digital technologies. As President Kim Dae Jung noted in his speech at the ASEM Leaders' Meeting in Seoul last year, "The phenomenon of the digital divide is emerging as a new obstacle to the balanced development of the global village... It is becoming a task that has to be resolved by Asia and Europe together..."

The basic remedies for this, I believe, include equitable sharing of the information infrastructure, computing capacity and information resources as well as international cooperation for education to enable people to take advantage of the Internet. These require enormous efforts from the international community, which I believe should be initiated by developed countries in cooperation with developing countries.

For human resource development, I would like to stress the necessity to establish an "APEC Youth Internet Volunteers Program" and an "APEC Cyber Education Network" that President Kim Dae Jung proposed at APEC fora. These proposed programs will help close the gaps by assisting the developing countries in the APEC region in enhancing their abilities to utilize information technologies and digitalizing their education systems.

The second issue that adds to the digital divide is language diversity or I should say lack of language diversity. English is the dominant language in cyberspace. A survey for 1998 shows that 81% of the Web pages were in English, and about 60% of all of the Internet users used English.[5] This suggests that many people who do not speak English are impeded when accessing the Internet, contributing to furthering the information divide.

We must overcome the language barriers and accelerate the development of language translation technologies with real-time translation so any one person on this planet can talk to another on the Internet. This will make international cooperation easier, and allow people to participate in the global community without losing linguistic and cultural heritage.

Third is the piracy of intellectual property on the Internet. The prevailing opinion of the international community seems to be that protection has to be granted even to the 'non-original' databases to secure the economic interests of the developers. While I concur with the opinion, however, I think that protection should not hamper the interests of scientific and educational circles working for the society at large or discourage free access to, exchange and dissemination of information. In particular, a clear distinction has to be made between the databases produced with public funds and those produced by private enterprises: the former must be freely accessible to all users.

Fourth, the Internet has and is still multiplying exponentially the potential for invasion of privacy and commercial fraud. Internet users are now exposed to the danger that their personal information may be misused or stolen, arousing serious concerns about privacy and financial losses on the Internet. This suggests that the Internet is likely to contribute to an increase in instances of human rights violations and other crimes, if it allows personal information to be misused for the invasion of privacy and/or criminal purposes on the Internet.

To prevent commercial fraud occurrences on the Internet, we need to take technical as well as legislative measures to insulate Internet users from any economic losses resulting from credit card piracy or other crimes in cyberspace. To prevent the piracy of personal information on the Internet, an international regime should be formulated on the basis of the eight principles on the protection of personal information as set forth by the OECD.

At the same time, website owners who collect and use personal data should develop, disclose and enforce strong customer privacy policies. It is neither an option nor a luxury. It is an essential ingredient of doing business on the Internet. The success of e-commerce hinges on this. I think this is one of the issues that the PTC, as an international organization comprising various sectors of the information and telecommunications industry, can best deal with.

Digitalization may hamper human development by affording people, particularly young people, to access morally and mentally harmful materials, such as pornography, defamatory publications and materials of use to criminals. Too easy access to controversial materials not only contributes to crimes involving youth, but results in a negative impact on the overall value system of our society.

To respond to harmful materials, a co-regulatory scheme sharing responsibility between government and industries is required along with an internationally accepted rating system. I also support the UNESCO proposal to establish an "Electronic Watchtower" as an instrument to oversee transactions and communications on the Internet.

Finally, I would like to mention today the problem that computer security poses. Over the past years, we have witnessed the devastating effects of computer hacking. Hacking poses a serious threat to the physical and financial well-being of millions around the world, by destroying or altering medical or bank records, and even compromising national security secrets.

To prevent cyber terrorism, an international alert system is required that includes such institutions as an "International Information Protection Center" and an "International Information Sharing and Analyzing Center," which are similar to the NIPC and ISAC of the United States.

More investments have to be made to develop the technologies required to achieve high levels of availability, reliability, security, protection and restorability of information services. We need technologies that can protect our systems from malicious electronic manipulations and attacks. Special measures also have to be taken to protect the critical network systems, such as the systems for power generation and distribution, banking, telecommunications, medical services, transportation, and national security.

None of the major challenges that I have discussed above can be dealt with successfully by any single country–they require the concerted efforts of governments, industries and civil society at the international level. Furthermore, leaving those challenges to the market alone could very well increase the digital divide and lead to overwhelmingly negative results for the future of the Internet and technology development in that area. I think we can best deal with these challenges together in a spirit of humanity and mutual trust. On the basis of humanity and trust, we have to formulate the rules of the game for the digital economy.

Here, I would like to stress that information technology should not be regarded as an end but as a means to promote and sustain human development. Therefore, in our move toward the information society, we should not repeat the mistake we have made over the past century by utilizing science and technology for short-term material welfare at the expense of the long-term sustainability of our human society. Digital technologies should be used in a way to improve the efficiency of production activities as well as to attain the sustainable development of our global community.

ICT in Korea

Ladies and gentlemen:

The Korean government prepared a plan called "Cyber Korea 21," which is the basic policy framework to transform the Korean economy into a mature digital economy. Based on this plan, nationwide efforts are underway to realize an "e-Korea," a digital welfare nation. Toward this end, we are pursuing programs to strengthen the information infrastructure, to enhance the overall productivity of the economy through digitalization, and to foster the software and Internet industries.

Now, information and telecommunications is one of the most dynamic sectors of the Korean economy, which has been leading the recent economic growth. The ICT sector explains 11% of the GDP, 28% of the exports, and 56% of the trade surplus. Of Korea's total population, 34% are now using the Internet, more than a half of the population carry cell phones, and the number of ".kr" domains has reached 513 thousand, which is equivalent to 1.09 per one hundred Koreans.[6]

It is very interesting to note that information awareness among the Korean people has been enhanced a great extent by private business enterprises called "Internet Cafe PC Rooms," where people can use a computer in the room to access the Internet over a cup of coffee, tea or some other refreshment.

These figures I just mentioned and the growth of Internet enterprises seem to indicate that Korea has now joined the ranks of the developed countries in the development of its information and telecommunications industry. Korea is well ahead of Asian countries in terms of the number of Internet users per unit population, and Korea ranks 11th in the world in terms of the number of domains per unit population.

This, however, does not necessarily mean that Korea has reached the advanced level in information and communications technologies. Korea still has a long way to go to join the ranks of the developed countries in digital technologies, and it still shares many common problems with developing countries.

As a country situated between developed and developing countries, we, Korea, would like to play a role as a linker in bridging the interests of developed countries and those of developing countries in the efforts to achieve a human-based global information society. Korea has been playing similar roles in various international fora, such as the OECD, APEC and others.

In order to facilitate and promote international cooperation between developed and developing countries in the environmental area, last year in Seoul we hosted an OECD Conference on International S&T Cooperation for Sustainable Development. We also initiated the APEC regional cooperation for the development of the Asia-Pacific Information Infrastructure. Through these efforts, Korea is contributing to the balanced development of the global community toward the era of the global information society.

I am pleased to note that the PTC mid-year seminar will be held this coming June in Seoul, and I hope this seminar will turn out to be another opportunity for Korea to play such a role.

Conclusion

Ladies and gentlemen:

A mature global information society, as I envision it, is a community where everyone can enjoy open and equitable access to the Internet and information technologies without worrying about invasion of privacy, piracy of intellectual property rights, misuse or theft of personal information, harmful materials, and hacking and cracking. It is a democratic, informed and inclusive society based on fair rules of the game in the cyberspace.

In pursuing such a society, we have to base our efforts on the principles of humanity and trust–a human-centered approach. In this respect, I would like to draw your attention to the teachings of a great thinker of our time, Mohandas Gandhi. He taught us that practicing "science without humanity" is one of the seven sins that we commit without perceiving it as a sin.

His message is that the ultimate objective of science is to serve the purpose of human advancement, and without a full understanding of the higher human value, we are bound to become the victim of our own technocracy.

If Gandhi lived today, I believe, he would teach us not to commit the sins of developing "technology without safety," propagating "information without reliability," and providing "education without reality." I think Gandhi's teaching on science and technology has a great deal of bearing on our efforts toward a human-based information society.

Let me now close by thanking the PTC Secretariat for their hard work in making this conference happen today, and wishing you the best for a successful conference and a happy new year. Thank you and see you all at the PTC mid-year seminar in June in Seoul.

Endnotes

[1]UNESCO, World Communication and Information Report 1999-2000

[2]Harold McGraw III, The Global Information Revolution: Opportunities and Obstacles, LA World Affairs Council, 2000

[3]Quoted from Harold McGraw

[4]Jung Uck Seo, *Keynote Speech at the TENCON-99*, September 15, 1999, Cheju, Korea

[5]UNESCO, World Communication and Information Report 1999-2000

[6]National Computerization Agency, *2000 Korea Internet White Paper*, Seoul

ROBERTO BLOIS, Deputy Secretary General, International Telecommunication Union

Mr. Roberto Blois Montes de Souza, born in 1950, has worked for more than twenty-five years in the field of telecommunications, gaining a wide and diversified range of experience in both technical and management areas.

After obtaining his Engineering degree in Electronics and Telecommunications from the University of Brasilia in 1974, Mr. Blois joined the Broadcasting Services Secretariat at the Ministry of Communications in Brazil. His career at this Ministry, which spanned a period of twenty years, enabled him to gain a wealth of experience and to play a key role in the development of the telecommunication system in Brazil at both policy and technical levels.

During the period 1979-1994, Mr. Blois served at the Ministry of Communications in Brazil as Director of the Broadcasting Division of the National Telecommunication Department, Director of the National Telecommunication Department and Director of the Department of Private Telecommunications Services.

In addition to his experience and activities at the national and regional levels, Mr. Blois has been a prominent figure in telecommunications affairs at the international level during the last twenty years. He participated in various meetings of the International Telecommunication Union (ITU) and the Interamerican Telecommunication Commission (CITEL), having acted as Head of the Brazilian delegation on many occasions.

Mr. Blois was the representative of Brazil in the Administrative Council of the ITU from 1990 to 1993. He was also the representative of Brazil in the Permanent Executive Committee of the Interamerican Telecommunication Conference COM/CITEL (OAS) from 1991 to 1993. After having held the position of Executive Secretary of CITEL from 1994-1999, Mr. Blois assumed the position of Deputy Secretary-General of ITU in February 1999 after having been elected to the post at the 1998 ITU Plenipotentiary Conference held in Minneapolis.

MARIA LIVANOS CATTAUI, ICC Secretary General

ICC Secretary General since 1996. Previously with the World Economic Forum in Geneva, responsible for the annual meeting in Davos. Graduate of Harvard University.

MICHAEL M. ROBERTS, **President & CEO, The Internet Corporation of Assigned Names & Numbers (ICANN)**

Mr. Roberto Blois Montes de Souza, born in 1950, has worked for more than twenty-five years in the field of telecommunications, gaining a wide and diversified range of experience in both technical and management areas.

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Biographies

Tadashi Nishimoto

Tadashi Nishimoto became Vice Chairman of the Board of DDI Corporation (KDDI) on 1 October 2000 following the tripartite merger among DDI, KDD and IDO. Prior to the merger, he had spent his entire career with KDD having joined the company in after graduating from Tokyo University where he received his LL.B.

During his career at KDD, Nishimoto spent more time dealing with international affairs than any other areas. He was stationed t in Washington, D.C. and was heavily involved in Intelsat business. Perhaps his most notable achievement was the chairmansh the Intelsat Board of Governors in the 1986/87 period during which he had to cope with an unprecedented incident ending in th discharging of the Director General of the organization.

Since being elected to the Board of KDD in 1987, Nishimoto successfully played the leading executive role in various sectors o company business, including international, human resources, marketing & sales and corporate strategy. Nishimoto was appoin as President of KDD in June 1996.

In May, 1998, Nishimoto received the prestigious Medal with Blue Ribbon from the Emperor, for his long dedication to the international telecommunications business.

Outside his profession, Nishimoto likes to play golf and tennis. He is also a licensed gardener. He lives with his wife, daughter, mother-in-law and 3 cats in Meguro, Tokyo.

The Role of a Network Operator in the Future of Internet and Mobile Communication

Tadashi Nishimoto

1) Global M&As in the Telecommunications

The Internet has the potential of revolutionizing our society, economy and politics. But for the telecommunications industry, it is already the central force of remodeling existing businesses and incubating new ones. Also, the Internet is rapidly expanding through mobile communication and expectations continue to rise towards the introduction of 3rd generation system as highlighted during the successful ITU TELECOM ASIA 2000 in Hong Kong last month which attracted tens of thousands of visitors.

Looking back the Millennium year, many strategic M&As were undertaken between different players for achieving larger scale of economy and integrating resources to develop Internet and mobile businesses.

We were no exception among such M&As motivated by current Internet and mobile trends. KDDI has emerged as a new operator after completing the three-way merger among DDI, KDD and IDO less than four month ago. Through this merger, we have built a solid ground for enhancing our next-generation businesses and contending against NTT by integrating all management resources the former three operators have developed. We are confident that we are migrating toward an advanced one-stop shopping company, capable of providing the full range of communication products and services, in all distances including Internet and mobile communication, to all corners of the market at competitive prices.

2) Construction of IP Network (Perseus)

Explosive growth of data traffic is calling for the provision of mighty IP platform. Having become a "Mobile & IP" network operator and expecting even greater consolidated traffic volume by the merger among three operators, KDDI is expanding the comprehensive next-generation IP network that we call "Perseus". This innovative network is in operation since last October at the speed of 2.4Gbps and foresees Terabit-level transmission. Our top priority is to achieve the best economy by using IP over WDM technology which connects optical cables directly to high-speed routers thereby drastically cutting equipment and management costs. Also, we plan to deploy new IP technologies, for instance, MPLS, QoS, VoIP, IPv6, IP Multicast and IP Sec for further enhancement. Our ultimate goal is to integrate all services and application on this infrastructure, in short, to realize "Everything over IP".

3) Provision of Advanced IP Solution (IP-VPN)

Surveys have shown that many corporate customers are still wary about risk of information leakage and hacker attacks on their Internet. Because the customers can hardly see how information is transmitted, it continues to be the network operator' s responsibility to protect the traffic for the customers' benefits. KDDI is now providing end-to-end global IP-VPN services using the latest Multi-Protocol Label Switching technology to meet their needs to build reliable and economical Intranets.

IP-VPN shares the public network and doesn' t require any mesh topology, so it costs less than a private line. Deeper inside IP-VPN, MPLS uses data-labeling to ensure security equal to that of ATM and Frame Relay services, enables faster transmission than conventional routing, reduces workloads of equipment, and allows various access methods. To expand its reach, KDDI is making the full use of its extensive global backbone network and the know-how we have developed in operation and maintenance of the network to bring about nationwide and global connection through IP over WDM.

4) Mobile Communication Boom in Japan

Now, turning to mobility, mobile phone business continues to surge across many Asian cities. For example in the Japanese market, the number of subscribers for the Mobile-Internet, such as EZweb and i-mode is skyrocketing (more than 26 million in two years) at the speed of more than 50,000 new subscribers per day, as the users are getting more and more attracted by convenience of its easy access to and distribution from the Internet. Also, the number of websites accessible from such mobile terminals has exceeded more than 20,000, and information service providers and new venture companies are flourishing. It is very true that the increase in the number of subscribers is helping that of websites and vice versa, and this is a wonderful business model. The subscribers can now enjoy a variety of information products and services, such as news, weather reports, sports, reservations, bank transactions, stock information, ringer-tone downloading, horoscopes, dating and any other recreational things anytime, anywhere. Also, more PDAs and home appliances are starting to be connected to one another through Bluetooth short-range radio technology and they will be new powerful wireless IP network terminals generating more data traffic. This phenomenon, or m-commerce is also expected to grow significantly. KDDI' s sales target for the mobile business in fiscal year 2004 is 2.7 trillion Japanese Yen, or about 25 billion US dollars, accounting for nearly 70% of planned total corporate revenue.

5) Intelligent Transport System Project (ITS)

When we think about developing new businesses featuring Mobile-Internet, cross-industrial convergence gives us clues. One of KDDI' s challenges is the Intelligent Transport System (ITS) Project, or the Smart Highway. This is an integration between mobile communication and transportation. What luxury and benefits could we enjoy if we introduce the Internet to automobiles? ITS will eventually turn all motor vehicles into intelligent terminals. By turning the ignition key, you are switching on a moving computer. Simply input your destination and the car will take you there, choosing the least time consuming route and will even find an empty parking space. Wouldn' t it be great if ITS could also achieve things like traffic jam reduction, automatic car diagnosis and giving priority to emergency vehicles? Driving will be more pleasant. You can work or relax, watch TV, even take a nap or drink! All the necessary things will be managed by wireless communication and traffic control. For this part, the network operators, such as KDDI, with their ample knowledge and know-how in these two areas can play a significant role. And, you can say goodbye to drunk-"driving", because you will be just a passenger! KDDI and Toyota Motor Corporation, our second major shareholder which holds 40% share in the 70 million Japanese automobile market, are strategically working together on this ITS, which is one of the advanced Mobile-Internet solutions with almost unlimited potential market, to differentiate ourselves from other operators. We are also convinced that our fiber-optical cables laid along highways nationwide, satellite communication and video compression technology will greatly benefit the KDDI Group in our ITS business.

6) Introduction of 3rd Generation Mobile

Toward the introduction of the 3rd generation mobile terminals in the next few years, many governments are conducting or considering 3G license auctions, and many mobile carriers are preparing to apply for the radio spectrum. Without going through any expensive auction in Japan, KDDI acquired the license and the spectrum which could be as valuable as billions of US dollars. Of course, we did spend much time in evaluating business plans for the choice between of W-CMDA and CDMA-2000 systems and chose the latter to minimize the additional capital expenditure by utilizing CDMA-One facilities. We are already offering 64Kbps on the CDMA-One and will accelerate up to 144Kbps through MC1x this fall to adequately meet customer requirements for mobile data communications market on a nationwide basis, whereas other Japanese mobile operators' full scale 3G may be provided in a limited geographical coverage at its initial launching. And by 2002, we are planning to deploy more advanced technology to offer 2.4Mbps speed.

7) Industrial R&D Activities

Technological innovations are coming from R&D, experiments and standardization activities in all areas of telecommunication, and both independent and joint studies are indispensable for prospective industrial evolution. One good example of KDDI' s own state-of-the-art technologies is our cutting-edge optical-fiber submarine cable system which our subsidiary KDD-SCS presented at this exhibition. Introduction of 3G mobiles and IP-enabled home appliances will definitely require an expanded IP address availability beyond the current IPv4, and prospects for transition to IPv6 is encouraging many companies to run IPv6 connectivity experiments. KDDI has initiated one experiment since last October, where we allocate IPv6 addresses assigned from Asia Pacific Network Information Center and provide IPv6 over IPv4 tunneling connection for our Internet subscribers at no additional charge.

Standardization activities continue at the ITU, IETF, ICANN and other organizations, and we see they are all promoting participation from the private sector at large, technical self-management and inter-organizational coordination as such principles became common by the rapid penetration and unprecedented impact of the Internet. The industry also runs organizational activities. Bluetooth Special Interest Group, set up in May 1998 by Ericsson which now has more than 2,000 company members, is working on short-range wireless connections in data & voice access, cable replacement and ad hoc networking among different handy devices with the aim of accelerating development and guaranteeing interoperability. R&D truly plays an important role in developing the Internet and mobile communication businesses.

8)The Digital Divide Issue

We are in the age of IT characterized by the Internet and mobile communication. The IT revolution is strongly driven by technological innovation, deregulation, privatization and introduction of market principles. However, it has become widely recognized that in those areas where people find private investments are hardly paying may be left behind without enjoying any benefits. We KDDI have been looking at this so-called Digital Divide issue over years and are making substantial efforts in developing some solutions. Examples are Wireless IP Telephony System and PHS-WLL (Wireless Local Loop) technology which we exhibited during the Asia-Pacific Summit on the Information Society last October. We are providing international training courses on these wireless solutions. We are very much committed to study and understand conditions and fundamental issues of rural areas of the developing countries, and keep our good work toward developing practical solutions with an aim of promoting self-sustainable development.

9) Toward the Future

The Internet and mobile communication will definitely be the mainstream in this new century. Network operators continue to pursue higher transmission speed, capacity and operation technology to gain edge on providing value-added information products. The key is how an operator could create original contents and applications that can differentiate itself from others. For instance, KDDI has outstanding expertise and records in video compression technology, one case of which we provided during the Olympic Games between Sydney and Japan for more than 100 million TV viewers, and we are confident that this will boost our possibilities in the Internet and mobile communication. They have already become vital social infrastructure and will be the new standard multimedia for highly personalized as well as customized for business use by accommodating speed, capacity, integrated transmission technologies and countless number of products and solutions. In order to meet the diversifying market requirements, KDDI, as the second largest network operator in the world' s second largest economy, is determined to make every effort in promoting the Internet and mobile communication by all means and to be a leader in the telecommunications industry of the Pacific.

Biographies

Name: Koichi Uchida
Date of Birth: October 2, 1949
General Education: Graduated from Faculty of Law, the University of Tokyo (1972)

Carrier and Experience:

1972: Entered the Ministry of Posts and Telecommunications(MPT), Japan
1991: Director, Welfare Division, Personnel Department
1993: Director, Personnel Division, Personnel Department
1995: Director, General Affairs Division, Telecommunications Bureau
1997: Deputy Director-General, Institute for Posts and Telecommunications Policy
1981: Assistant Vice-Minister, Communications Policy Bureau
1999: Director-General, international Affairs Department

(6 January 2001 Reorganization of ministries and agencies)

Director-General, International Affairs Department Telecommunications Bureau,
Ministry of Public Management, Home Affairs, Posts and Telecommunications(MPHPT), Japan

HON. WARWICK L SMITH, LLB

Warwick Smith is an Executive Director with Macquarie Bank Limited, Australia's only independent, full service investment bank with offices throughout Australia and 22 countries around the world.

Warwick is head of the Bank's Corporate Communications Division, which incorporates government relations, media and public relations, corporate event management and brand and marketing. This Division supports the operating businesses of the Bank with their marketing activities.

In additional to his Divisional role, Warwick is also the Co-Chair of the Bank's Telecommunications Media and Technology (TMt) Group. The TMt Group provides a coordinated suite of innovative financial products to the telecommunications, media and technology sector. Established at the beginning of 1999, the Group has secured a number of significant domestic and international mandates.

Underpinning Warwick's co-chairmanship of the TMt Group has been his role as a leading player in the telecommunications and broadcasting public policy debates in Australia since the 1980's and more particularly, during the 1990's. In the Australian Federal Parliament he was involved in the major legislative changes to Australian telecommunications, broadcast and radio communication laws.

Warwick continues his interest with industry development and community affairs, following his former Federal Parliamentary time, through participation on various Boards within these spheres.

FINANCIAL AND LEGAL EXPERIENCE

Professional

- Executive Director, Head of Corporate Communications Division, Macquarie Bank (since 1998)
- Former Partner, Douglas&Collins (one of Tasmania's oldest law firms, specialising in commercial law)

Prior to joining Macquarie Bank, Warwick held an association with the Bank working as a consultant between 1995 and 1996. In particular, Warwick assisted with Macquarie's bids for international cross-border leasing and local domestic leasing mandates.

Current Membership

- Member, Senior Bankers Group, Macquarie Bank (since 1998)
- Member, Financial Institutions Group, Macquarie Ban
- Member, Australian Bankers Association Steering Committee

TELECOMMUNICATIONS INDUSTRY EXPERIENCE

Professional

- Co-chair of Macquarie Bank Telecommunications, Media and Technology Group (TMt) (since 1999)
- Chairman Australian Communications Industry Forum Ltd (2000)

- Board member, Artsim Pty LTD
- Telecommunications Consultancy - key clients included Clayton UTZ lawyers, KPMG and Macquarie Bank LTD (1996)
- Australia's first Telecommunications Industry Ombudsman (1993-95)
- Representative for Communications, the Information Economy and the Arts in the House of Representatives (1998)
- Representatives for the Environment and Communications in the House of Representatives (1996-98)
- Acting Minister for Communications (1996-98)
- Shadow Ministerial Service - Communications (1984-93)

Warwick has been at the forefront of telecommunications reform and public broadcasting debates through his former Ministerial roles and in being appointed the first Ombudsman to the Australian Telecommunications Industry. Warwick's involvement has included participation in the public policy debates driving legislative reform. In his current role as CO-chair of the Macquarie Bank TMt Group, Warwick continues to be associated with fostering development within the industry (from an investment banking perspective). For example, Warwick was associated with Macquarie Bank's $14 billion IPO of Telstra Corporation Limited.

Awards

- 1999 - Chairman's Award presented by Australian Telecommunications Users Group
- 1994 - Charles Todd Memorial Medal for Communicator of the Year

Membership

- Member Pacific Telecommunications Council
- Australian-American Leadership Dialogue Group
- Law Council of Australia-Media and Telecommunications Committee
- Board Member The Global Foundation
- Member of Advisory Board RMIT University - Network Insights Group

INDUSTRY DEVELOPMENT EXPERIENCE

Professional

- Deputy Chair, Tourism Task Force
- Former Member, Federal Government Electrical Energy Export Advisory Committee
- Board Member - The Global Foundation
- Board Member - The Documentary Foundation

Warwick takes a pro-active role in terms of fostering industry development and participatingin current reform debates. This interest is reflected through his Board membership to a diverse range of industry development areas.

PARLIAMENTARY EXPERIENCE

Warwick was elected to the Federal House of Representatives on 1st December 1984 (as youngest Liberal in Parliament). He was re-elected in 1987, 1990 and 1996.

Ministerial Service

In Australian Federal Parliament, Warwick Smith had responsibility for a number of portfolios.

1998 Minister for

- Family Services
- Representative for Communications, the Information Economy and the Arts in the House of Representatives

1996 - 1998 Minister for

- Sport, Territories and Local Government
- Minister assisting the Prime Minister for the Sydney 2000 Games
- Representative for Environment and Communications in the House of Representatives

1996 - 1998 Acting Minister for

- Health
- Communications
- Industrial Relations
- Environment
- Administration Services

1984 - 1993 Shadow Ministerial Service

- Science and Energy
- Acting Industrial Relations
- Aboriginal Affairs
- Privatisation
- Communications

- Leader of the House

Committee Service

- Chair of Aviation Transport and Communications Policy Committee,
- Chair, Law & Government Policy Committee,
- Deputy Chair of the Economic Committee of the Shadow Ministry 1993,
- Member of House of Representatives Standing Committee of Expenditure,
- Deputy Chair of the House of Representatives Standing Committee on Legal and Constitutional Affairs, and
- Deputy Chair of the select Committee of Inquiry into the Print Media in 1991

Reports Included:

- Infrastructure Funding in Australia
- Insider Trading
- Corporate Legislation
- Merger Monopolies & Takeovers
- Shareholders Rights

COMMUNITY CONTRIBUTION

Professional

- Board member, Mission Australia
- Board member, Philanthropy Australia
- Board member, Good Beginnings
- Inspire Foundation Patron
- Member, Care Australia

Warwick serves on a number of Boards concerned with providing valuable and necessary community services.

PERSONAL DETAILS

Date of Birth: 13 May 1954

Private Address: 15 Linden Avenue

PYMBLE NSW 2073

Contact Tel Nos: 612 9282 6059

(Mobile) 612 0419 591208

Married, with three children.

Plenaries

Monday 15 January 2001– Plenary Sessions

0830–1030

Plenary Session

(Webcast, sponsored by Compaq)

Location: Tapa Ballroom

Moderator:

DIANA SHARPE. Chairman, International Telecommunications Users Group, *United Kingdom*

Speaker:

Dr. JUNG-UCK SEO, Minister of Science & Technology, *People's Republic of Korea*
Toward the Global Information Society - Opportunities and Challeges

Panelists:

ROBERTO BLOIS, Deputy Secretary General, International Telecommunication Union

MARIA LIVANOS CATTAUI, Secretary General, International Chamber of Commerce

MIKE ROBERTS, President & CEO, The Internet Corporation of Assigned Names & Numbers (ICANN)

1600–1730

Plenary Session

(Webcast, sponsored by Compaq)

Location: Tapa II

Introduced by:

Governor Benjamin Cayetano, State of Hawaii, *USA*

Speaker:

NOBUYUKI IDEI, Chairman & CEO, Sony Corporation, *Japan*
Power Point Presentation

Wednesday 17 January 2001– Plenary Sessions

1400–1600

PTC2001 Closing Plenary

(Webcast, sponsored by Compaq)

Wednesday, 17 January 2001

Tapa Room

THE VIEW AHEAD
THE ROLE OF GOVERNMENT, INDUSTRY
AND USERS IN THE INTERNET'S FUTURE

The session will discuss the issues that were raised during PTC2001 and build upon the theme of the conference - From Convergence To Emergence - Will the User Rule?

With a diverse PTC audience of international interest groups, the session is intended to be an interactive discussion from the perspectives of the carrier, government, business and average user.

Chair:

WINSTON. THOMPSON, Chief Executive Officer, Telecom Fiji Limited, *Fiji*

PTC Mid Year Preview
NAM JIN CHO, PTC Korea Chapter, *People's Republic of Korea*

Carrier Perspective
TADASHI NISHIMOTO Vice Chairman, KDDI, *Japan*
The Role of a Network Operator in the Future of Internet and Mobile Communication

Government Perspective
KOICHI UCHIDA, Director-General of International Affairs Department Telecommunications Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT)

Major Users' Perspective
HONORABLE WARWICK SMITH, Executive Director, Macquarie Bank, *Australia*

Individual User Perspective
GREGG DAFFNER, Chief Strategic Officer, q-east broadband, *USA*

NOBOYUKI IDEI, President and Chief Executive Officer, Sony Corporation

Noboyki Idei was named Chief Executive Officer, Sony Corporation, in June 1999. He had served as Co-Chief Executive Officer since May 1998, and President and Representative Director, Sony Corporation, since April 1995. Prior to that, Mr. Idei was Managing Director, Sony Corporation, since 1994.

Mr. Idei has played a key role in moving Sony into the digital age and in developing and enhancing Sony's renowned design and brand image throughout his career. He oversaw areas of Corporate Communications and Advertising as a Director and then Managing Director of Sony Corporation from 1989-1995. During that time, he also served as Senior General Manager of the Creative Communication Division (1994), Products Communications Group (1993), Merchandising and Product Communication Strategy Group (1991), and Advertising and Marketing Communication Strategy Group (1990).

With his strong background in international marketing, Mr. Idei has contributed significantly to Sony's reputation as one of the worldwide leaders in the consumer audio video industry as Deputy Senior General Manager, Video Group (1986) and Senior General Manager, Home Video Group (1988). He has been instrumental in Sony's involvement in the computer business and was a key figure in the establishment of Sony's compact disc market, and the strengthening of Sony's consumer VCR business. Internationally, he was active in the establishment of Sony's European market presence, particularly through the opening of Sony France in the late 1960's and early 1970's.

Mr. Idei joined Sony in 1960 after graduating from Waseda University, Faculty of Politics and Economics. He also attended L'Institute des Hautes Etudes Internationales in Geneva, Switzerland (from 1962 - 1963). His family includes his wife, Teruyo, and a daughter, Mari. He is fluent in English and French, and his interests include golf and movies.

Pacific Telecommunications Council Speech

January 15, 2001 (Honolulu, Hawaii)

Greetings

- Aloha, Happy New Year and Happy New Century.

- We have been talking about the 21st century for such a long time, and now it is finally upon us.

- Our new century is characterized by many new beginnings.
  - One of the most evident new beginnings is in the United States, which finally has a new president. It was interesting to watch the US elections last year.
  - For many months, I have been warning Japanese Prime Minister Mori that Japan must race to catch up with the US in the area of computer and network technologies.
  - But then I saw election officials using punch cards, the same sort of punch cards I used over 30 years ago. Clearly, the US is not as computerized as I thought.

- Over the New Year holidays, I read a cute little book called, ***Who Moved My Cheese?***, by Dr. Spencer Johnson.
  - It talked about the difficulties of adapting to change.
  - For the telecommunications, broadcasting, media and computer industries, now is a time of great change. Today I will talk about how I perceive that change and its impact on companies, industries and nations.

What happened to convergence?

- For years, people have been predicting the convergence of media. It has yet to happen.

- Several years ago, Bill Gates said that PCs and TVs would converge. That did not happen.
    - WebTV, which allows you to send email using a TV, did not become a hit.
    - TV sales are as strong as ever, especially large-screen models.

- Bill Gates also predicted that we would play games on our PCs. That did not happen on a large scale either.
    - In fact, Sony's PlayStation and PlayStation2 have sold more than 90 million units worldwide.
    - Bill Gates is even developing his own game machine, the X-Box.

The 30 Degree Principle: The Barrier to Convergence

- When I tried to analyze why the PC and TV have not converged, I realized that the two have totally different characteristics. I call this the "30 degree principle."

- When you watch TV, you usually lean back about 30 degrees and relax. TV is a passive medium and very easy to use. TV programming appeals to our emotional senses.

- When you are using PCs, you usually lean forward about 30 degrees and focus. PCs are an active medium, somewhat complex to use. PCs involve logical thinking.

- While most of us would be happy when our Internet search produces a result within 10 seconds, no one would tolerate such slowness when TV channel surfing.

- TVs and PCs are so fundamentally different and the two shall never converge…at least not in the current environment.

Analyzing the times (1/2)

The Three Phases of the Internet

- Before I go on further, I would like to summarize how I characterize the current environment.

- I think the Internet has shown three distinct phases.

  - The first period of the Internet was characterized by the emergence of cyber companies. Some of these companies created totally new businesses, such as AOL and Yahoo! Others were cyber forms of old businesses, such as Amazon.com or E-Trade.

  - The second period of the Internet was characterized by the comeback by real companies. Established companies, such as Merrill Lynch and Barnes & Noble, realizing the impact of the Internet on their businesses, began staging a comeback by establishing their own cyber presence. The Empire Strikes Back, so to speak.

  - The third period of the Internet has been characterized by the convergence of cyber and real companies. This period was set off by the announcement of AOL and Time Warner's merger in January of last year.

Analyzing the times (2/2)

Paradigm Shift

- The Internet has caused a fundamental paradigm shift from the industrial age to the information age.

- The US, which was the first to embrace the Information Age, has reaped the greatest benefits.
    - According to Digital Economy 2000, the US economy expanded for 10 years in a row and is only recently beginning to slow.
    - World Competitive Scoreboard ranks the US number one, whereas Japan is number 17.

Current Situation (1/2)

From narrowband to broadband

- Now we are entering into the fourth stage of the Internet era, the transition from narrowband Internet to broadband.

- What do I mean by broadband?
    - multiple distribution channels (telephony, cable, satellite, wireless)
    - multiple access avenues (PCs, PDAs, TVs, refrigerators and other non-PC devices)
    - multiple content choices (text, images, music, video, one way and interactive, personal and mass media)

- I do not consider 1~5 Mbps broadband. That would only be high-band. Broadband is something along the lines of 30~100 Mbps.
    - A CD takes 23 hours to download on current narrowband networks, but with 30 Mbps, it would take just 3 minutes.

- Characteristics of broadband are:
    - Pervasive network (always on, everywhere, like oxygen)
    - Customized information. Information comes to you, not the other way around.

Broadband and convergence

- Broadband will trigger the first true beginning of convergence.

- But unlike past predictions of convergence, I do not think it will be PC centric.

- We are seeing the early signs of convergence with the web-capable i-mode cellular telephones in Japan.
  - This chart shows the explosive growth in i-mode subscribers. In less than two years, there are now more than 17 million subscribers.

- The strong popularity of our VAIO computers is also a hint of the type of convergence to come. When we introduced VAIO in 1997, we tried to create a totally new concept in personal computing.
  - VAIO stands for Video Audio Integrated Operation.
  - VAIO is an entertainment rather than productivity tool.
  - Since introducing the VAIO 505, an ultra-light notebook PC, we have expanded the sub-notebook market almost 15 times and Sony has consistently commanded more than half of the market share in this category.

Sony's strategy in the broadband era

- With broadband technology, TV, games machines, PCs and other information devices will be connected to the network.

- And because of this trend, our strategy has changed. Sony has for many years been an AV champion in the manufacturing era. But we know the era of the stand-alone AV product is over.

- Now, Sony is pursuing a comprehensive strategy to become a Personal Broadband Network Solutions Company.
  - We are doing so by making easy-to-use network gateways. Currently, our four main gateways are digital TVs, PCs, the PlayStation and mobile products.
  - By using our assets in movies, music and games, we are also developing unique network content for these network gateway products.
  - And to differentiate ourselves from our competitors, we are creating new network services and applications.

- We are calling this integrated business model strategy the Sony Dream World. Our goal is to provide new forms of entertainment lifestyles for the broadband age.

Demonstrations

- To illustrate this strategy, I have asked my staff to demonstrate two new products. Both are just an early look at what is possible with broadband networks.
  - The VAIO GT is a sub-notebook PC with an “eye,” a built-in video camera. We will demonstrate how products like this make personal broadcasting a reality.
  - The Airboard is a new wireless TV and PC in one. You can read or send email, watch TV or video in a wireless environment.

  - **DEMONSTRATIONS** (Justin Hill explaining)

Japan

- Sony's success in this broadband strategy is linked with Japan's ability as a nation to make itself competitive in the broadband era.

- Since the 1960s, Japan was a champion of the Manufacturing Age. Its strong manufacturing sector, especially in electronics and automobiles, created a level of prosperity that made it the post-war economic miracle. Ezra Vogel even wrote the book, "Japan as Number One."

- But the past ten years have been a Lost Decade for Japan. Economic growth stagnated and stock prices dropped by 50 percent.
  - Japan's annual GNP growth in the 1970s: 5%
  - in the 1980s: 3.8%
  - in the 1990s: 1.7%

- One of the reasons for Japan's Lost Decade was its failure to transform itself for the Information Age.

- Japan did not let go of such past successes and was too slow to adapt to the new environment of the Information Age.

Japan's IT Strategy

- But Japan has gradually come to realize that it needs to transform itself to be a powerhouse in the broadband era.

- In July last year, Prime Minister Mori set up an advisory committee called the IT Strategy Council and appointed me as chairman.

- The goal we set out was to have Japan become an Internet superpower within the next five years.

- To achieve this goal, I set out four grand strategies.
    - To encourage investments in building a super-high-speed Internet infrastructure

    - To deregulate and create new rules to promote e-commerce.

    - To create an electronic government that provides services to its citizens via the Internet

    - To implement a new educational system that fosters critical and creative thinking

- This is a very realistic goal, despite America's huge lead.
    - Japan is a small country, about the size of California, which makes building a network physically easier.
    - Japanese telephone and electric companies have already built the trunk lines of a nationwide fiber optic network. Only legal regulations prevent them from opening them to the public.

Broadband Era Challenge: The Digital Divide

- Europe, the United States and many countries in Asia have created national strategies to develop their IT infrastructure.
    - US's National Information Infrastructure Initiative
    - South Korea's Cyber Korea 21
    - Singapore's Master Plan for IT

- As Thomas Friedman says in his book, ***Lexus and the Olive Tree***, with globalization and information technology, a nation's strength will be determined by speed rather than size.

- While it is important for us to pursue our corporate and national strategies to become leaders in the new age, one problem we must address is the Digital Divide.

- For the economically disadvantaged, there are problems such as infrastructure barriers and language barriers
    - The US, Sweden and Japan have more than 600 lines per 1000 people, whereas India has only 27 lines per 1,000 and China, only 90.
    - 80% of all web sites are in English, although less than 10% of the world's population speaks English.

- For the technically disadvantaged, there are huge portions of the population who are not comfortable with information technologies.

User Interface / IPv6

- One way Sony is trying to address the Digital Divide is by creating easy, intuitive user interfaces on all our products.
    - You saw an example of this with the Airboard. People who have never used a PC can use this product to surf the Internet and send e-mail.

- Another way to address the Digital Divide is to connect more non-PC devices to the Internet. Key to this is Internet Standard Protocol version 6 or IPv6.
    - The current IPv4 system provides only 4.3 billion IP addresses, most of which are already taken by the US and other IT-advanced countries. With IPv6, we will have more than one trillion times one trillion times one trillion IP addresses.
    - This will be enough for every network device and household product the world over. Even refrigerators or bathtubs can have their own IP addresses.

Partnering in the Broadband Era

- It is hard to tell which nations or companies will lead in the new broadband era.

- But in such a complex environment, leadership will be difficult to achieve alone.

- According to the book, ***Trillion Dollar Enterprise*** by Cyrus Friedheim, competition will not be among individual companies, but among networks of companies.
  - Already, we have seen the airline industry form networks called Star Alliance and OneWorld.

- In the past, companies were brought together through hard alliances, in other words, friendly M&As or hostile takeovers.

- Times are changing however. With a meteorite called broadband technology, hard alliances are increasingly difficult to achieve among companies with different corporate natures and cultures. Companies that force hard alliances may be threatened with extinction, like the dinosaur.

- For companies with different natures, the key may be soft alliances. Soft alliances allow companies to collaborate on specific areas that bring mutual benefits without requiring a merging of corporate culture and identity.

Impact of Broadband Era

- I would like to ask our audience today, “Where is your new cheese in the broadband era?”

- Today we have cable, satellite and terrestrial broadcast, public telephone networks, mobile networks and home networks. Up until now, each was in a distinctly different industry.

- In the coming broadband era, I think these networks and industries will no longer remain separate.
    - For example, there was a clear distinction between common carriers and IP carriers. One handled voice, the other handled data. In as soon as five years, the two will converge.
    - In addition, companies like Sony, Cisco, Hewlett-Packard and other companies involved in network related hardware may become a new breed of communications company.

- This is both a threat and an opportunity. Rather than fight for a smaller piece of the same old cheese you have been eating for years, I challenge you to take this opportunity start thinking about new business models and new alliances with other companies, industries and nations.

Conclusion

- Who knows? With so much industry convergence in the broadband era, even automobile manufacturers, such as GM and Toyota, may become members of the Pacific Telecommunications Council.

- I hope that this week's PTC conference will give you a sniff of where your cheese is in the broadband era.

- Thank you and now I would like to open the floor to any questions you may have. **[Q&A until 5:30pm]**

Workshops & Roundtables

Sunday 14 January 2001
0900–1200

Workshops

WKS1 Essentials of Broadband & Emerging Technologies: Infrastructure & Services

Location: Honolulu Suite

Facilitator: RAY HORAK, President and GPB, The Context Corporation, USA

This session explores the world of broadband communications, focusing on infrastructure and services. Infrastructure is examined in terms of access and transport technologies, including Digital Subscriber Line (DSL), Wireless Local Loop (WLL), and SONET/SDH. The wireline services discussion compares and contrasts IP (Internet Protocol) versus ATM (Asynchronous Transfer Mode). Wireless Internet discussion focuses on WAP (Wireless Access Protocol), contrasted to iMode. This session is a highly dynamic, fast-paced and plain-English discussion of the latest developments in the broadband networked world.

Download PowerPoint Presentation

back

Essentials of Broadband & Emerging Technologies: Infrastructure & Services

PTC 2001

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BroadBand Networks: Characteristics

I speak and I write…but more, it's with light(ning) that I connect.
poet Giovanni Pascole, 1891
translated by Daniel Minoli

- Bandwidth: DS-3+, T-3+, 45 Mbps+
- Bandwidth-on-Demand
- Error Performance Excellent
- Network Management Prospects
- Availability Limited
- Cost: High
- Resiliency: Highly Redundant

Broadband Access Technologies

- Digital Subscriber Line (DSL)
- CATV (Community Antenna TeleVision)
- Wireless Local Loop (WLL)

generic Digital Subscriber Line (xDSL)

- Asymmetric DSL (ADSL)
- Rate Adaptive DSL (RADSL)
- G.lite (ADSL lite)
- ISDN DSL (IDSL)
- High-bit-rate DSL (HDSL)
- Symmetric DSL (SDSL)

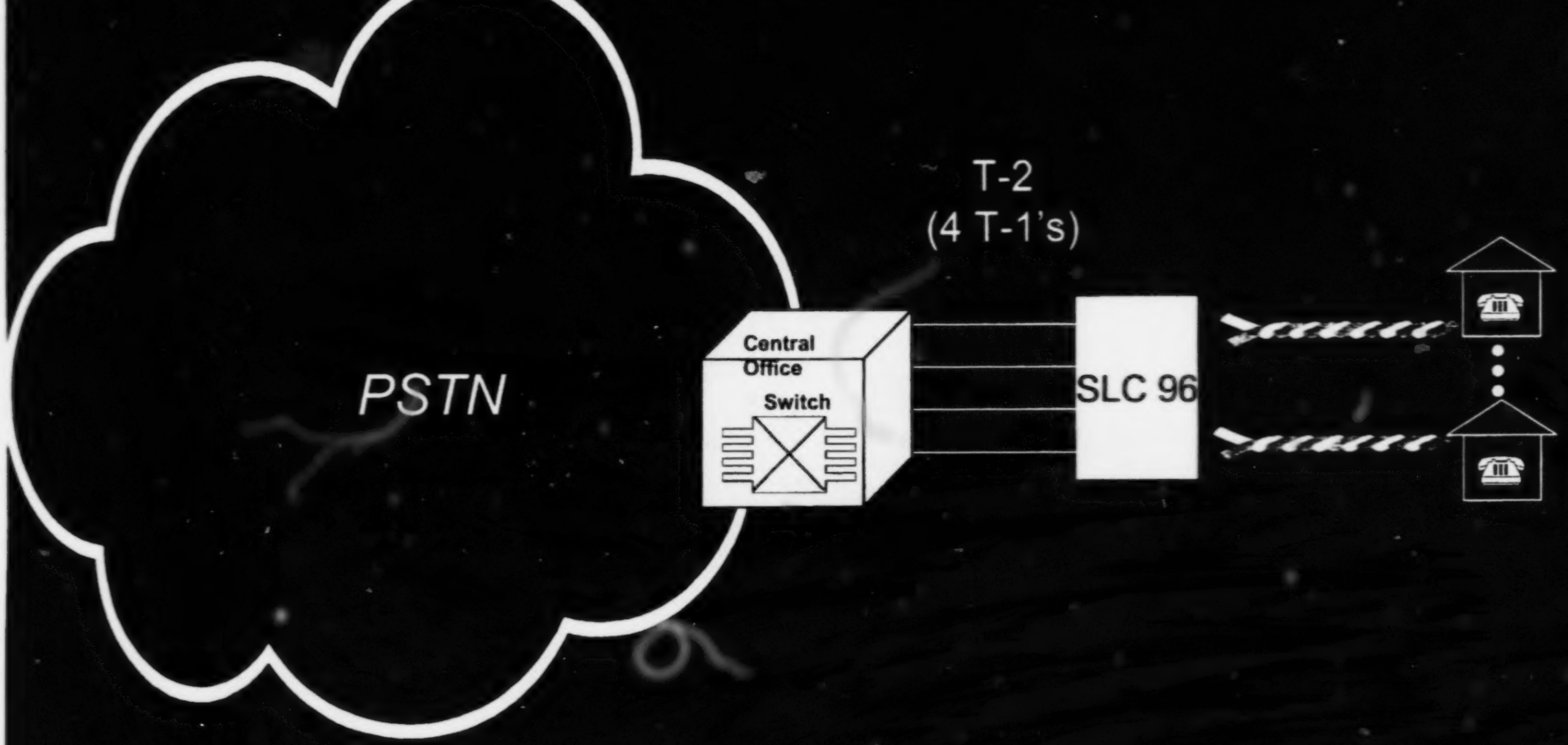
DSL Characteristics

- ILEC Local Loop
- Telecom Act of 1996
- UTP Medium
- Applications
  - Internet Access
  - Voice
  - Entertainment TV
- Frequency Division Multiplexing (FDM)
  - Voice:
    4 kHz and below
  - Data and Video:
    25 kHz and above
- Digital Channels:
  - Data and Video
  - Highly Compressed

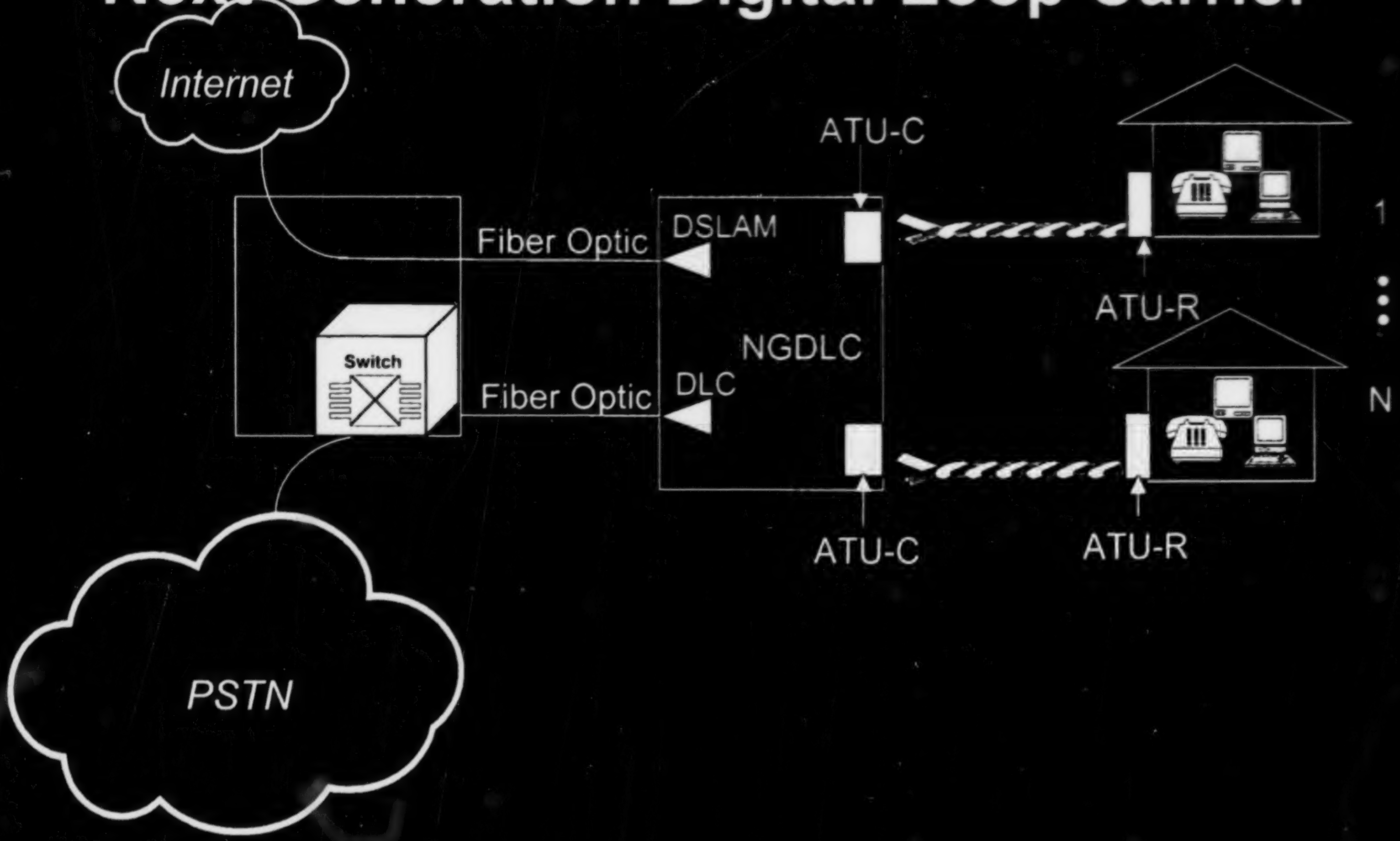
Local Loop Issues

- Loop Length
- Splices and Mixed Gauges
- Bridged Taps
- Load Coils
- Interference
- Inside Wire
- Voice Terminal Signaling States
- Digital Loop Carrier
- Splitters or Modems
  - Centralized
  - Decentralized
- DSL Access Multiplexers
- SPOT Frames

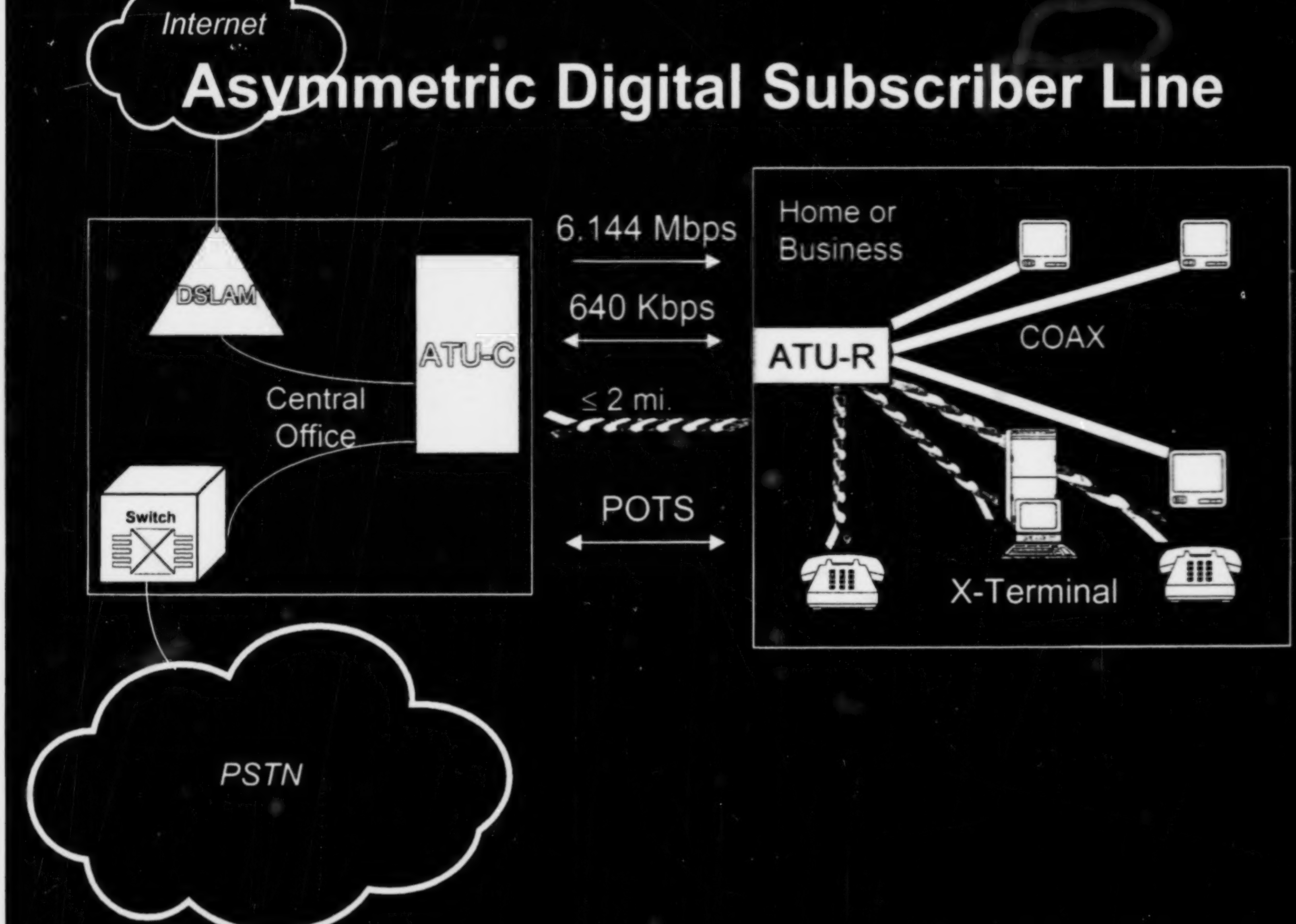
Conventional DLC


PSTN
Central Office Switch
T-2
(4 T-1's)
SLC 96

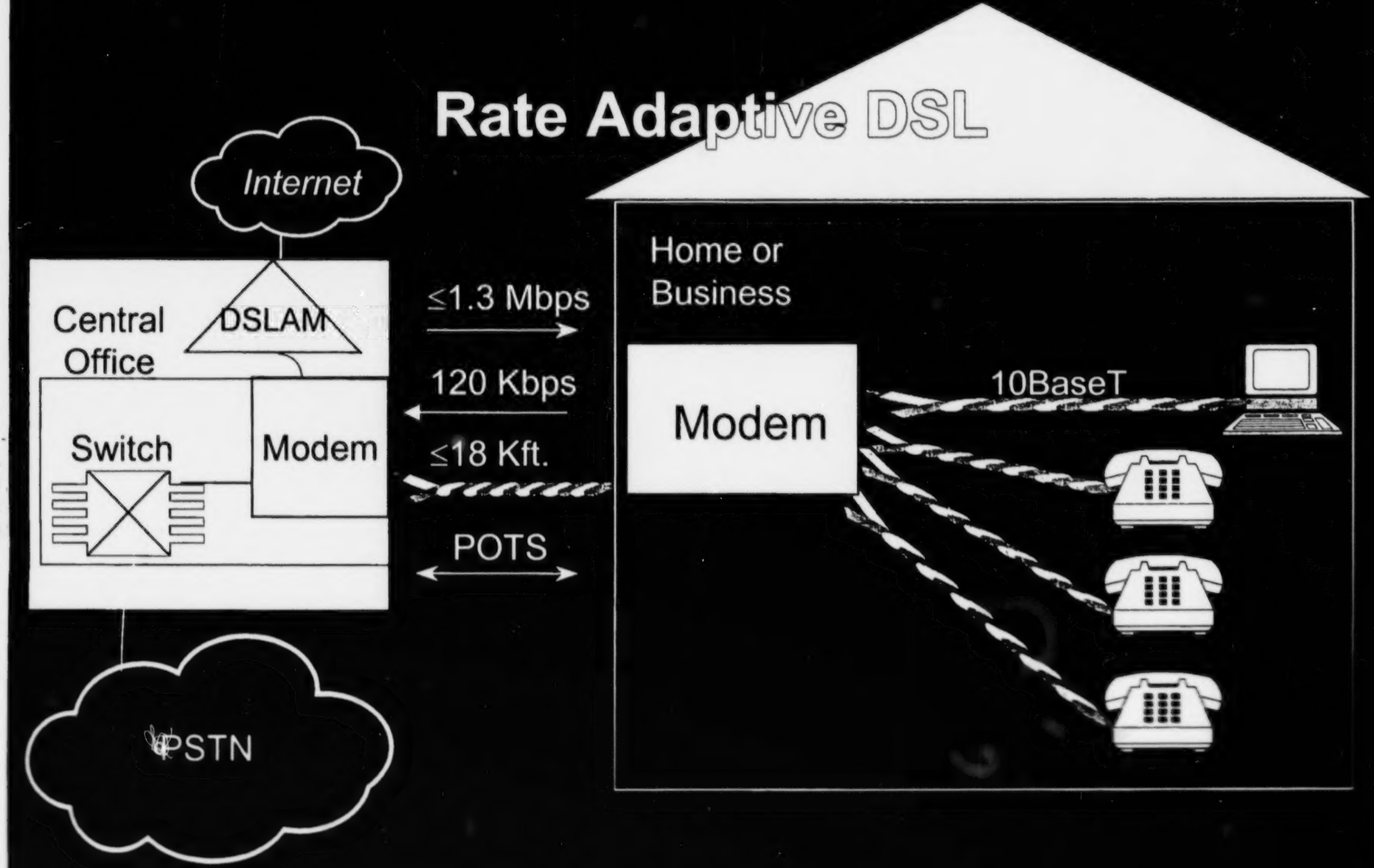
Next Generation Digital Loop Carrier


Internet
ATU-C
Fiber Optic
DSLAM
1
ATU-R
Switch
NGDLC
Fiber Optic
DLC
N
ATU-C
ATU-R
PSTN

Asymmetric Digital Subscriber Line


Internet
DSLAM
ATU-C
Central Office
Switch
PSTN
6.144 Mbps
640 Kbps
≤ 2 mi.
POTS
Home or Business
ATU-R
COAX
X-Terminal

Rate Adaptive DSL



Internet

Central Office

DSLAM

Switch

Modem

≤1.3 Mbps

120 Kbps

≤18 Kft.

POTS

PSTN

Home or Business

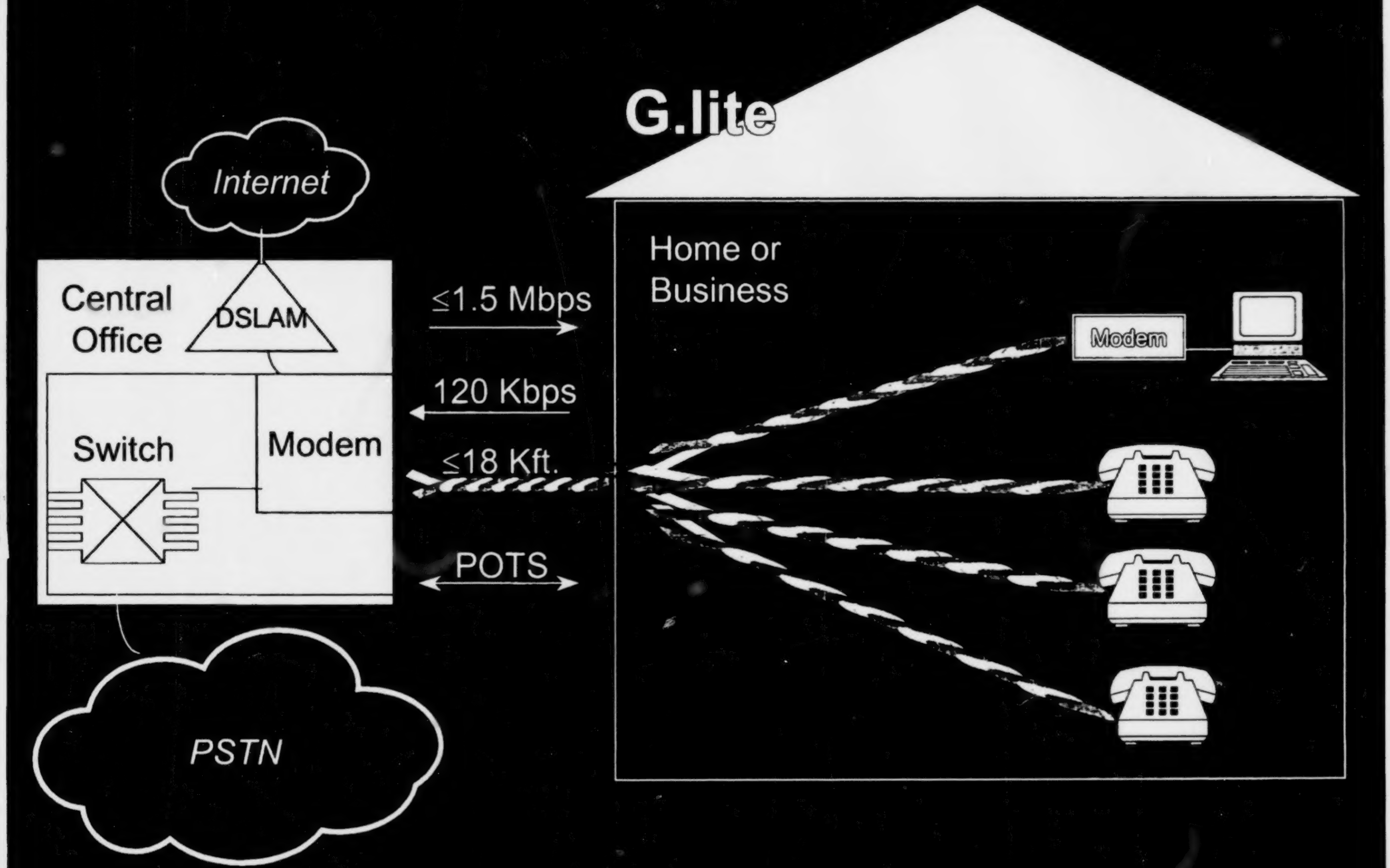
Modem

10BaseT

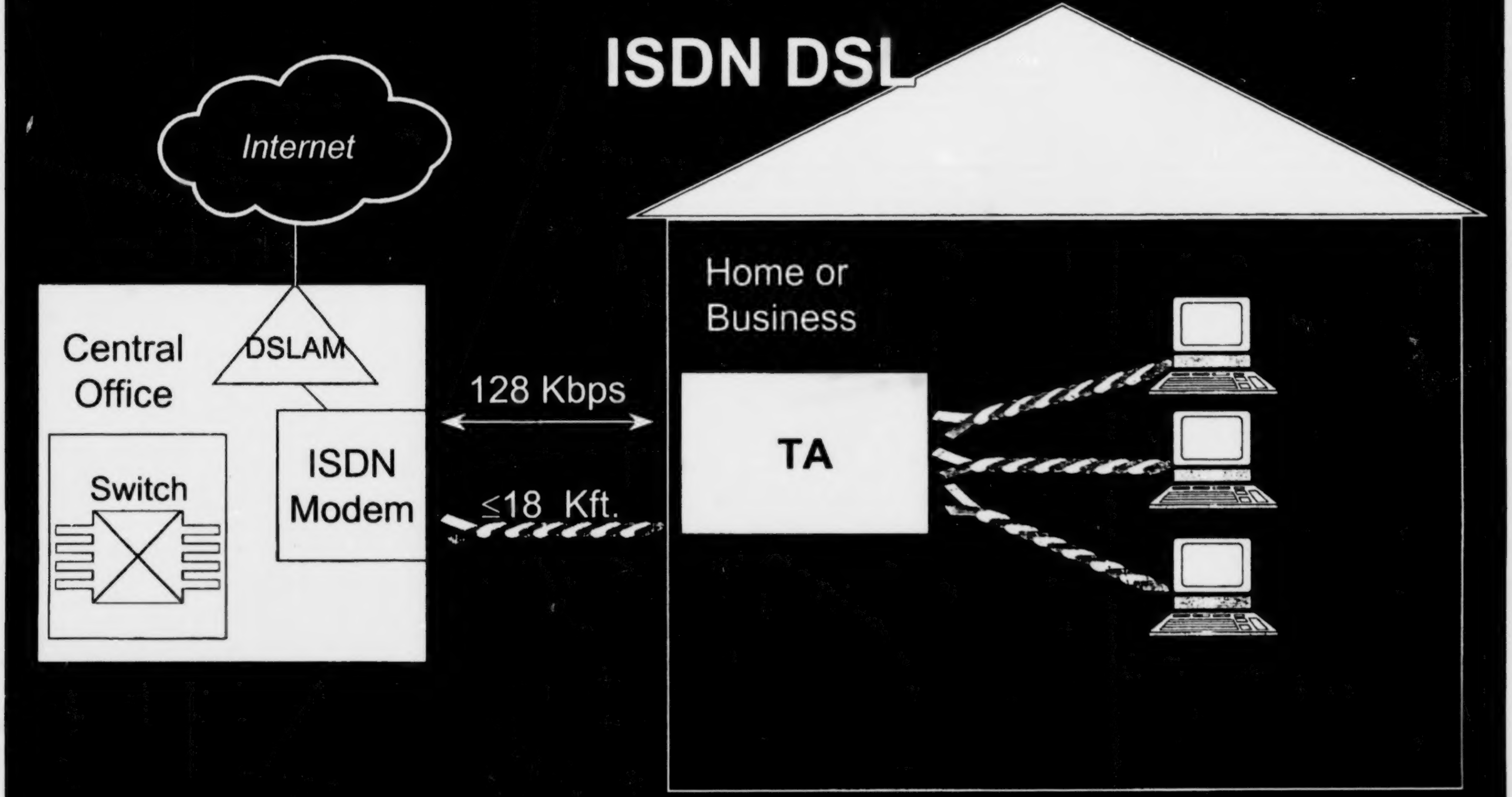
G.lite

- Splittered ADSL
- Distributed Splitter ADSL
- Splitterless ADSL

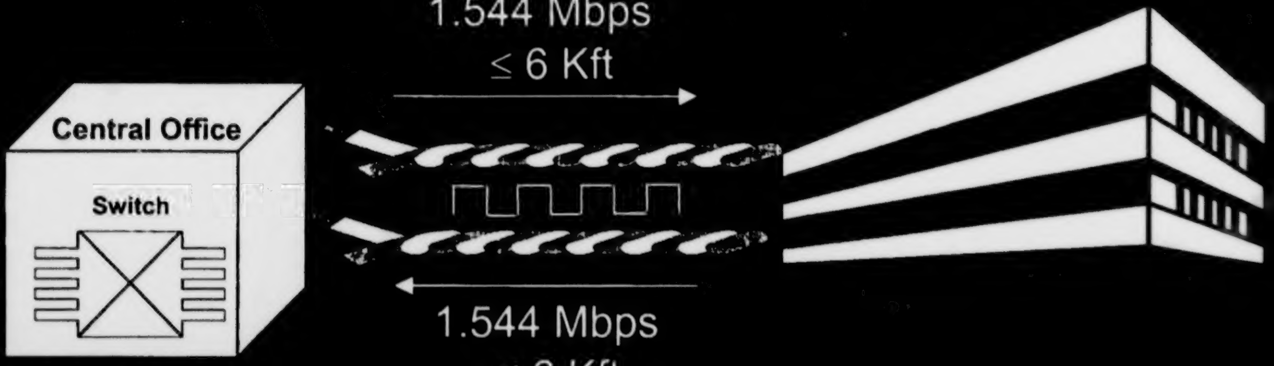
G.lite


Internet
Central Office
DSLAM
Switch
Modem
≤1.5 Mbps
120 Kbps
≤18 Kft.
POTS
PSTN
Home or Business
Modem

ISDN DSL


Internet
Central Office
DSLAM
Switch
ISDN Modem
128 Kbps
≤18 Kft.
Home or Business
TA

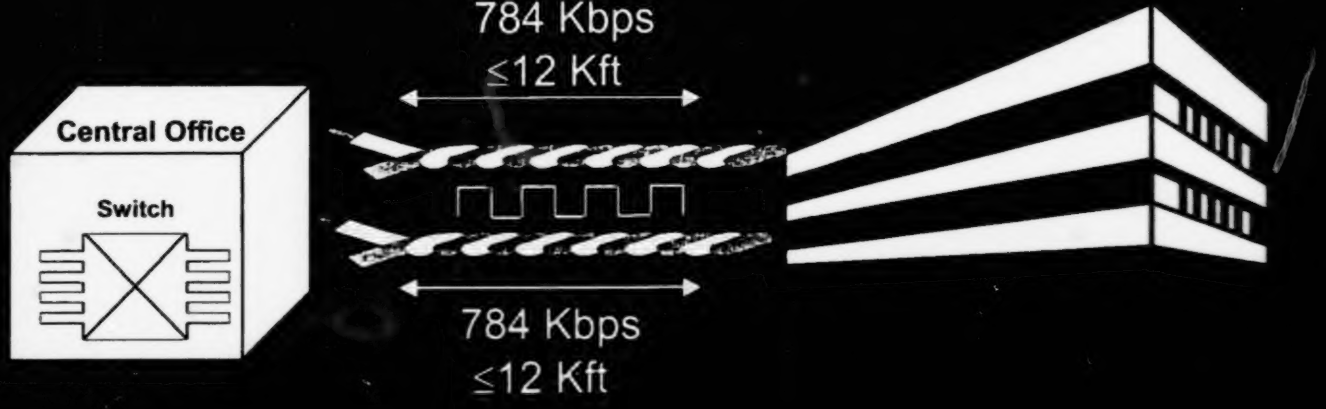
T-1


Central Office
Switch

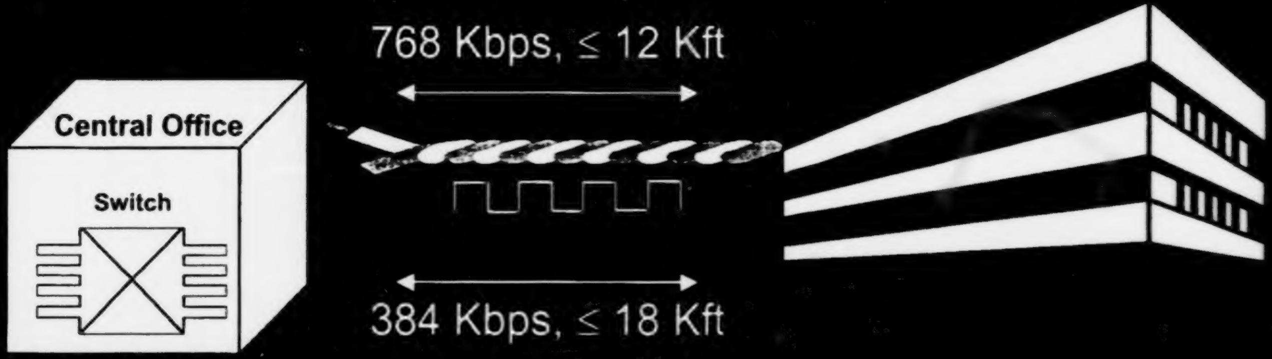
1.544 Mbps
≤ 6 Kft

1.544 Mbps
≤ 6 Kft

High-bit-rate DSL


784 Kbps
≤12 Kft
Central Office
Switch
784 Kbps
≤12 Kft

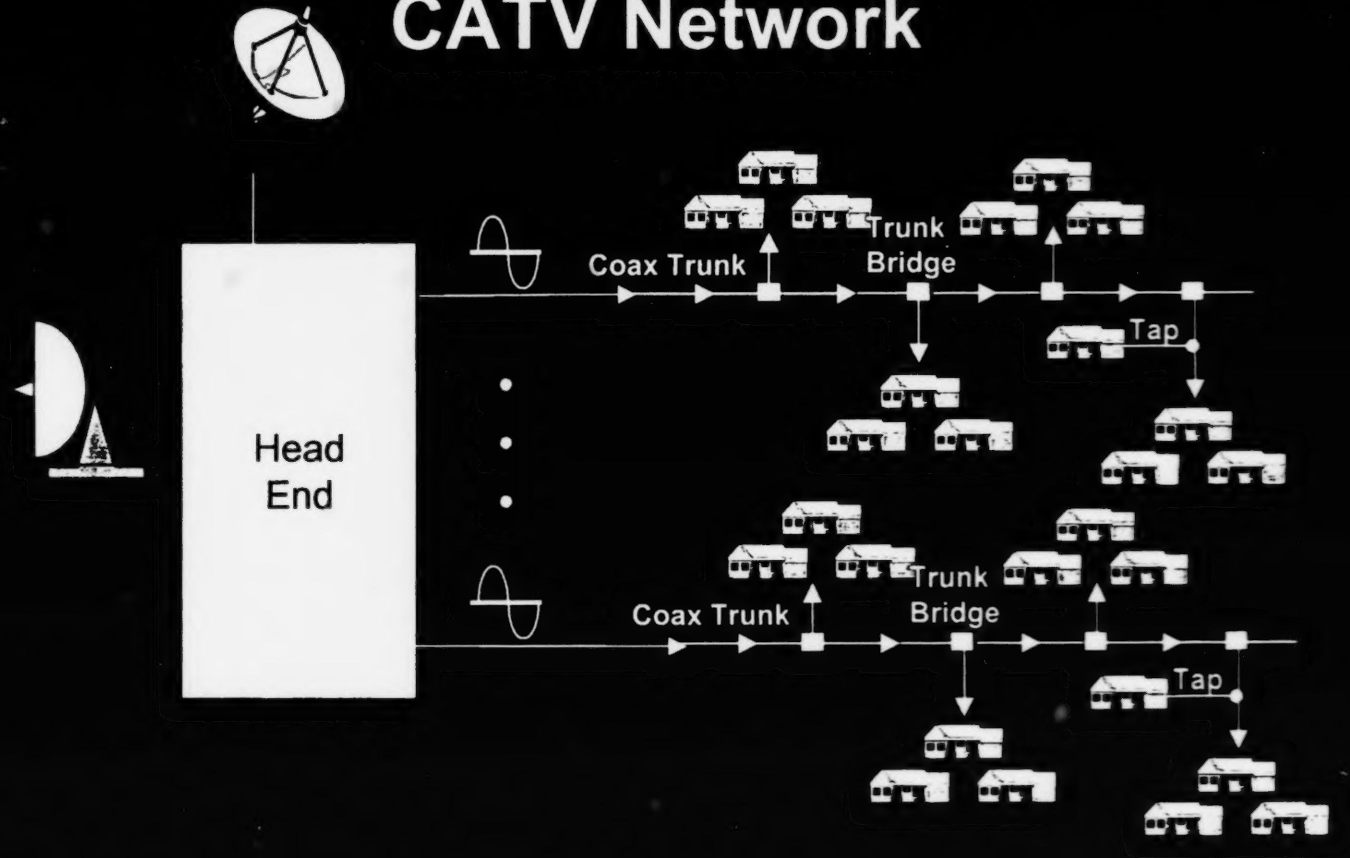
Symmetric DSL


Central Office
Switch

768 Kbps, ≤ 12 Kft

384 Kbps, ≤ 18 Kft

CATV Network



Head End

Coax Trunk

Trunk Bridge

Tap

Coax Trunk

Trunk Bridge

Tap

CATV Network Characteristics

- Shared Local Loop ala 10Base5 Ethernet
- Tree and Branch Architecture
- Closed System
- Medium
  - Analog Coax
  - Hybrid Fiber Coax (HFC)
- Applications
  - Entertainment TV
  - Packet Internet Access
  - Packet Voice
- DOCSIS Standard
- Frequency Division Multiplexing (FDM)
  - TV
    - 6 MHz Channels
  - Data:
    - 6 MHz Downstream
    - 5-42 MHz Upstream
  - Voice: Packet
- Digital Channels:
  - Data and Video
  - Highly Compressed

Wireless Local Loop (WLL), or Fixed Wireless

Overcomes Wired Local Loop Problems

- UTP Limitations
- Speed of Deployment
- ILEC Ownership

Wireless Local Loop (WLL)

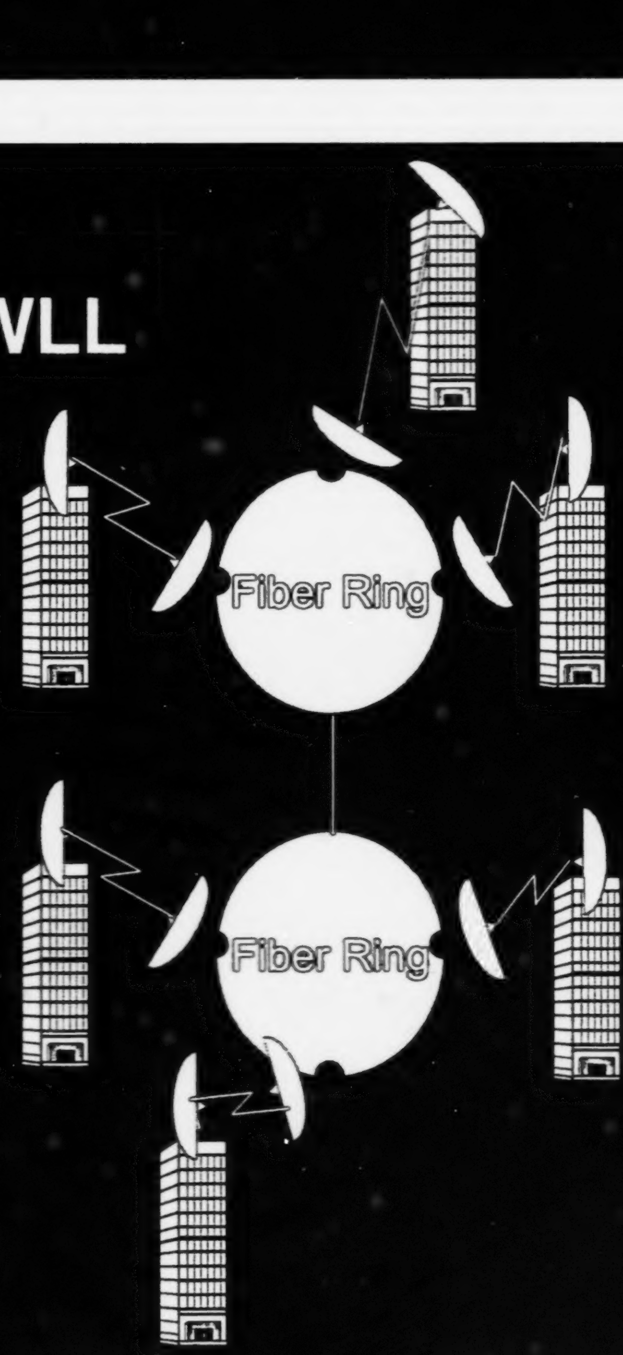
Advantages

- Rapid Deployment
- Low Cost Deployment
- Frequency Reuse
- Remote Configuration, Reconfiguration, and Management

Disadvantages

- Limited Spectrum
- Electromagnetic Interference (EMI)
- Rain Attenuation
- Line-of-Sight
- Licensing
  - Lengthy
  - Expensive
- Security

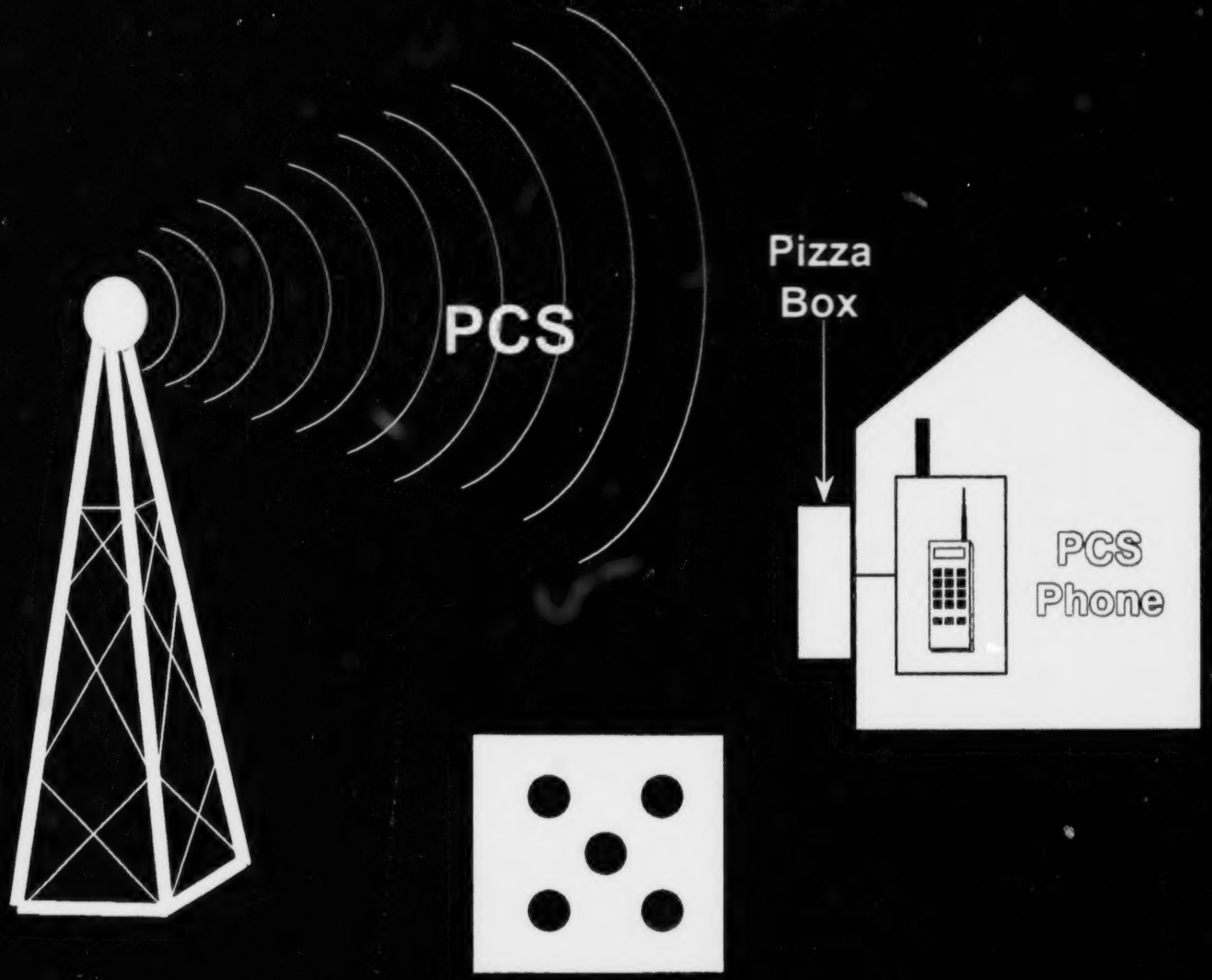
Hybrid WLL


Fiber Ring
Fiber Ring

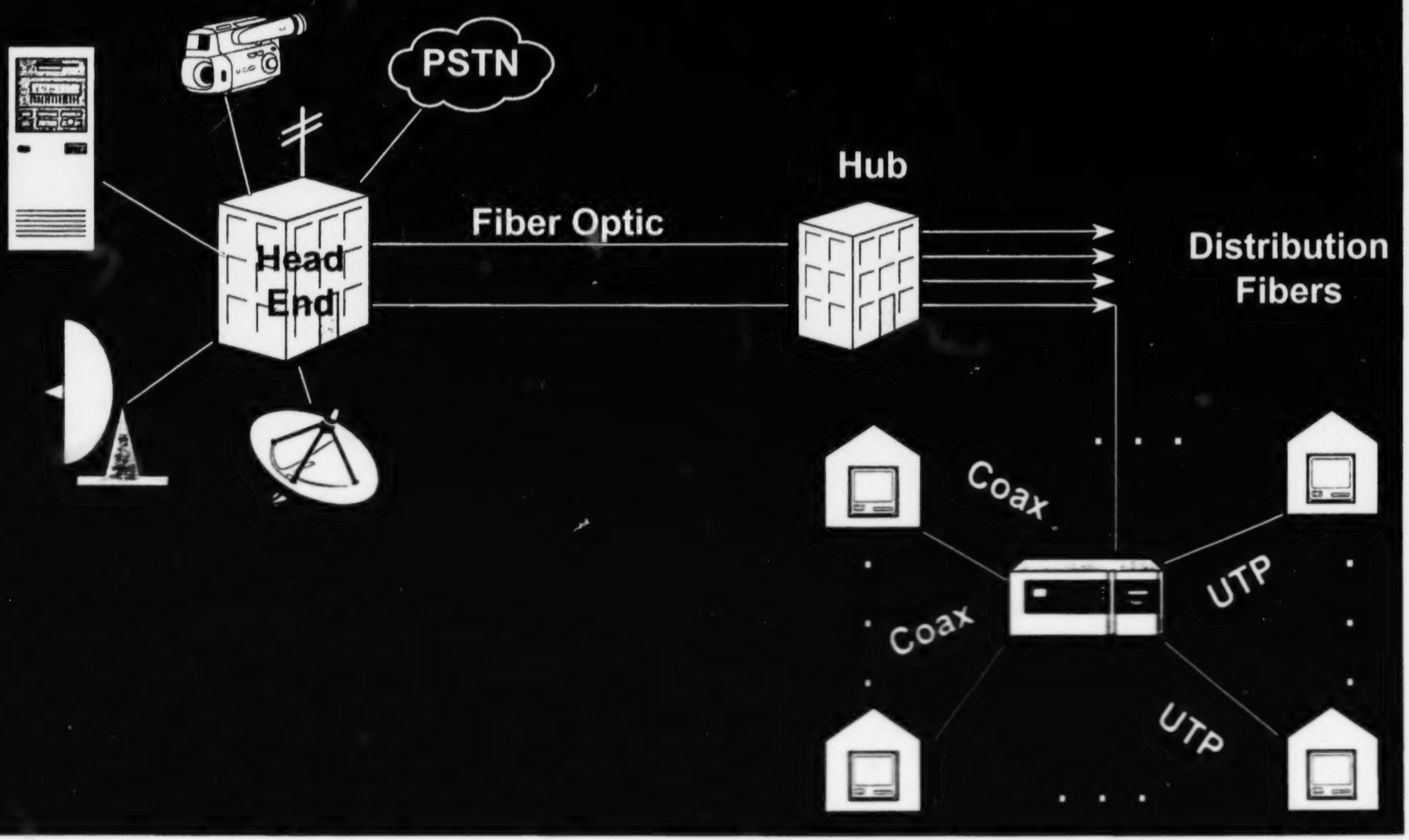
Personal Communications Services (PCS)

- Narrowband
  - AMPS Spectrum
  - 900 MHz
  - Pagers and Cell Phones
- Broadband
  - Below 2 GHz
  - WLL, Voice and Data, Pedestrian
- Unlicensed
  - Above and Below 2 GHz
  - WLANs, WOTS, PDAs, In-Building

PCS WLL


PCS
Pizza Box
PCS Phone

Hybrid Local Loop


PSTN
Head End
Fiber Optic
Hub
Distribution Fibers
Coax
Coax
UTP
UTP

BroadBand Networks: Characteristics

I speak and I write...but more, it's with light(ning) that I connect.
poet Giovanni Pascole, 1891
translated by Daniel Minoli

- Bandwidth: DS3+
- Bandwidth-on-Demand
- Error Performance Excellent
- Network Management Excellent
- Availability Limited
- Capital Investment: High
- Cost per Bit: Insignificant

SDH/SONET:
Defined

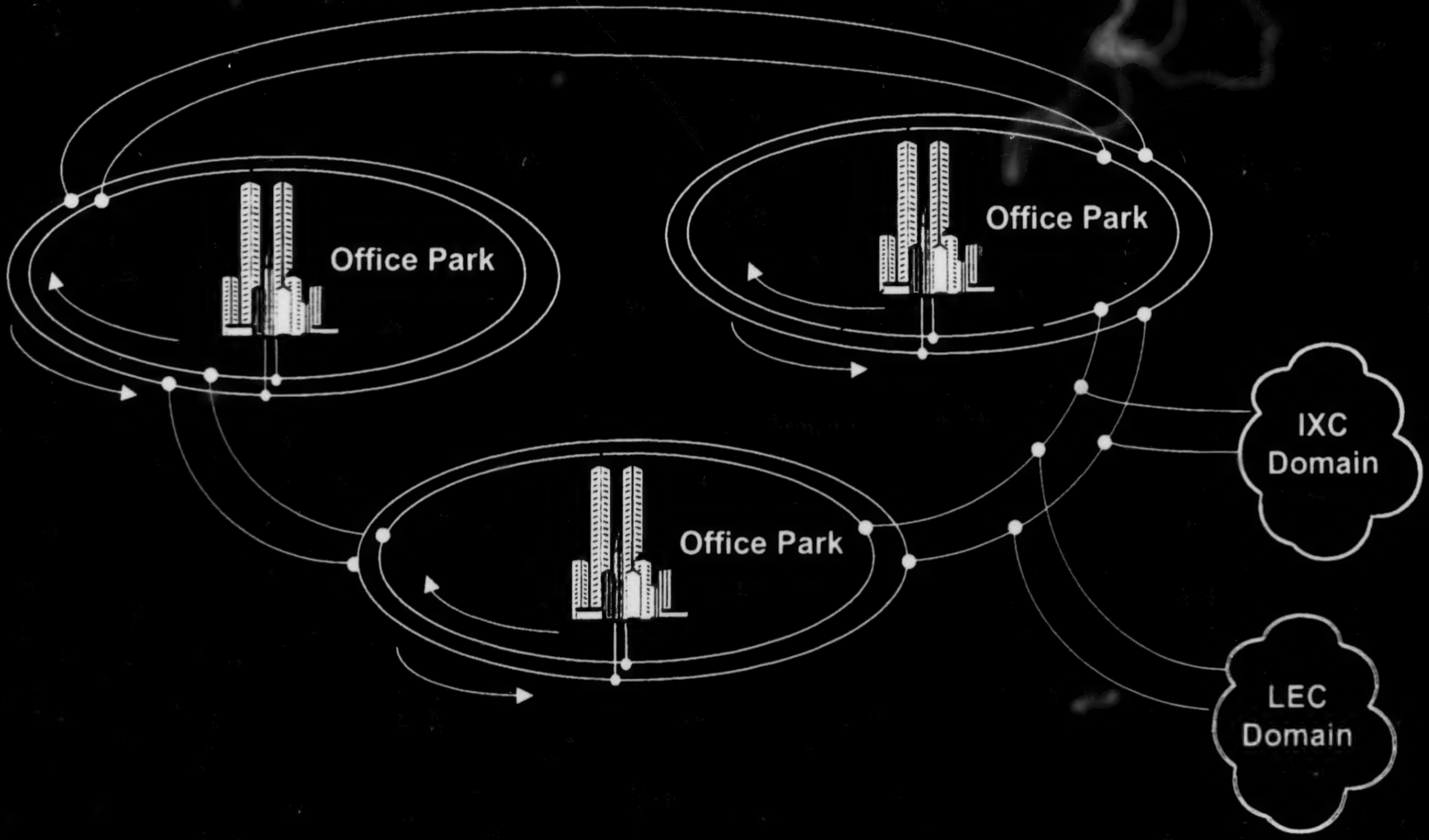
SDH/SONET is a set of international standards for broadband communications over fiber optic transmission systems, supporting full interconnectivity and interoperability. Switching and multiplexing techniques are defined. Asynchronous, synchronous and isochronous traffic are supported.

Synchronous Digital Hierarchy

LEVEL	STS	STM	SDH/SONET Line Rate	DS-3 Channels	Voice Channels
OC-1	STS-1	--	51.84 Mbps	1	672
OC-2*			103.68 Mbps	2	1,344
OC-3	STS-3	STM-1	155.52 Mbps	3	2,016
OC-9*	STS-9	STM-3	466.56 Mbps	9	6,048
OC-12	STS-12	STM-4	622.08 Mbps	12	8,064
OC-18*	STS-18	STM-6	933.12 Mbps	18	12,096
OC-24	STS-24	STM-8	1.24416 Gbps	24	16,128
OC-36	STS-36	STM-12	1.86624 Gbps	36	24,192
OC-48	STS-48	STM-16	2.48832 Gbps	48	32,256
OC-96*	STS-96	STM-32	4.97664 Gbps	96	64,512
OC-192	STS-192	STM-64	9.95328 Gbps	192	129,024
OC-768	STS-768	STM-256	39.81312 Gbps	768	516,096

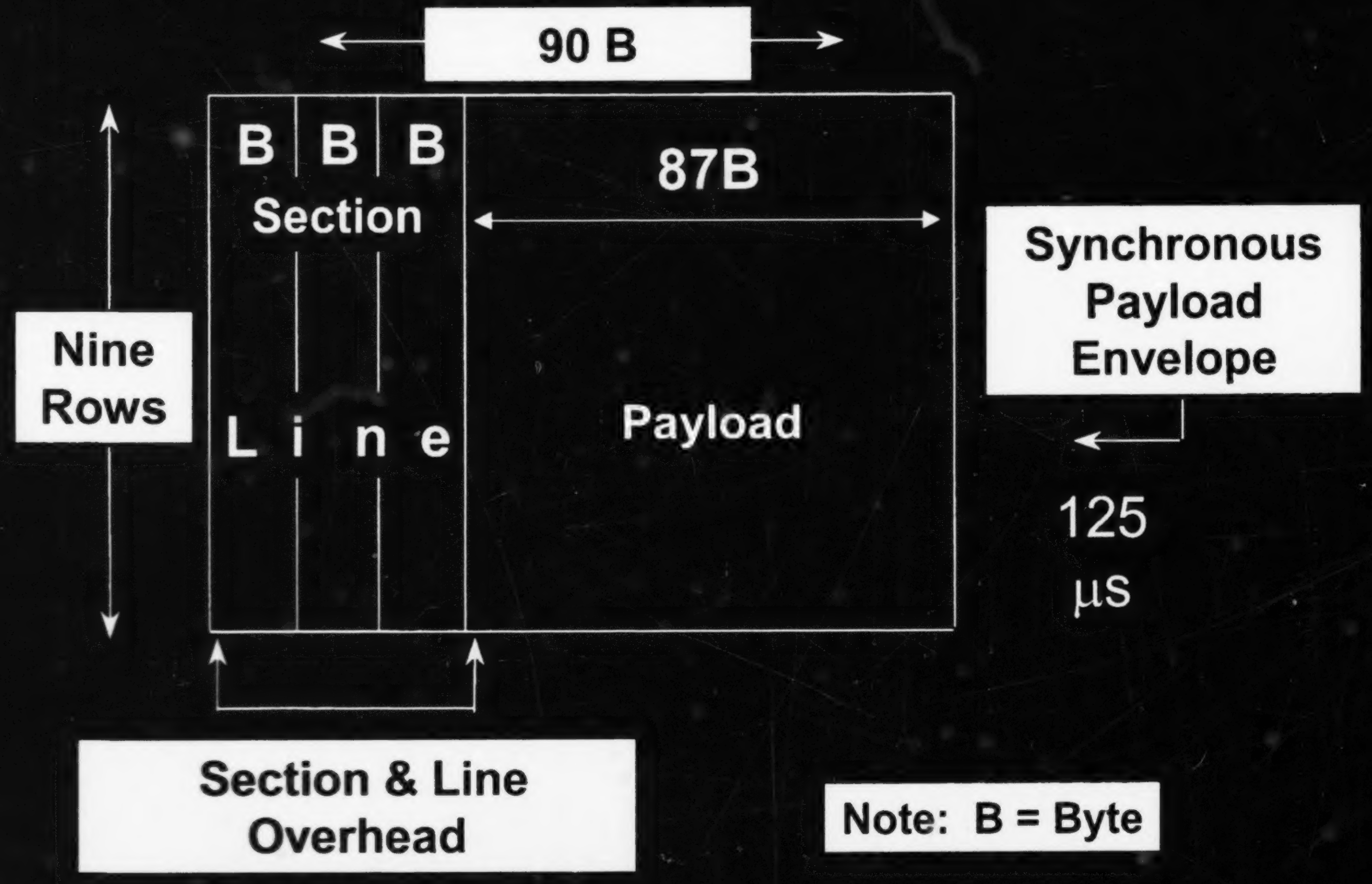
*OC-2, OC-9, OC-18, and OC-96 are considered orphaned rates

Nested SONET Rings



Office Park
Office Park
Office Park
IXC Domain
LEC Domain

SONET Frame Format



90 B

B B B

Section

87B

Nine Rows

L i n e

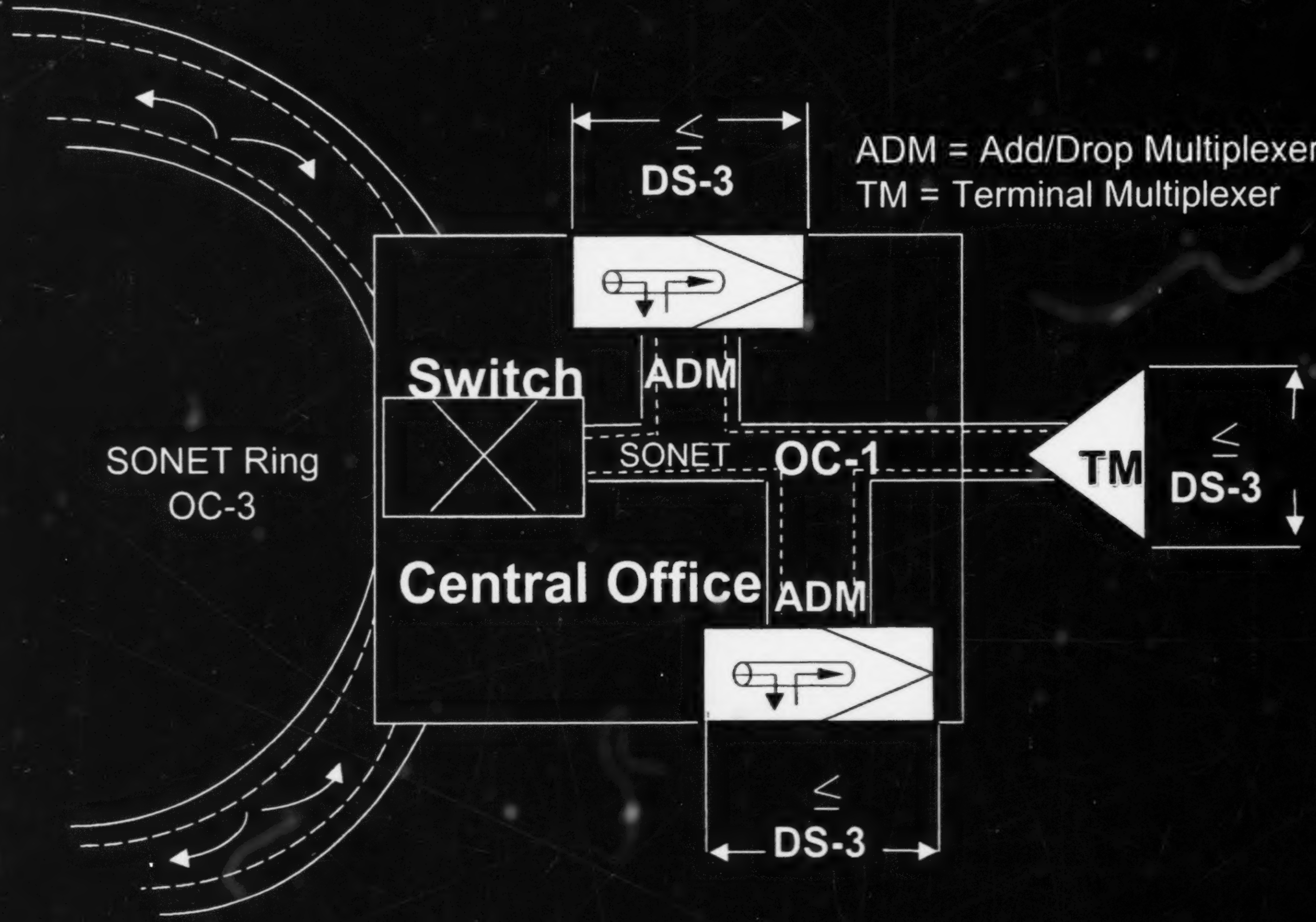
Payload

Synchronous Payload Envelope

125 µs

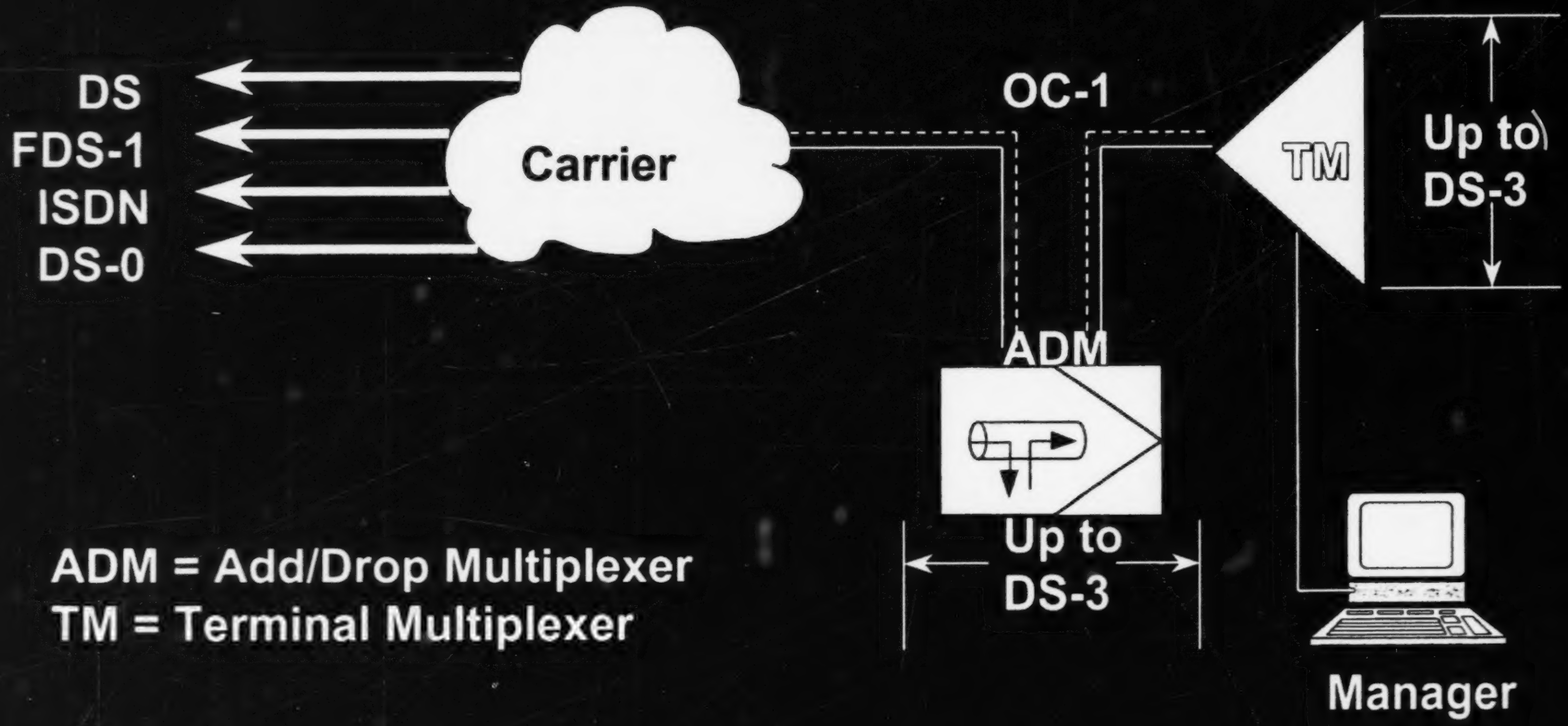
Section & Line Overhead

Note: B = Byte


SONET Ring
OC-3
Switch
Central Office
SONET
OC-1
ADM
ADM
TM
≤
DS-3
≤
DS-3
≤
DS-3

ADM = Add/Drop Multiplexer
TM = Terminal Multiplexer

SONET Multiplexing


DS
FDS-1
ISDN
DS-0
Carrier
OC-1
TM
Up to
DS-3
ADM
Up to
DS-3
Manager

ADM = Add/Drop Multiplexer
TM = Terminal Multiplexer

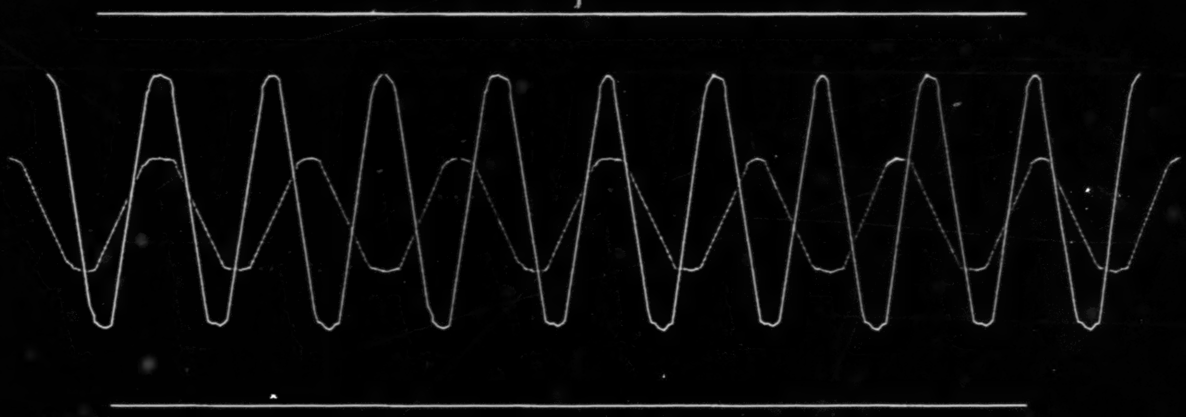
SDH/SONET:
Advantages

- Interconnectivity & Interoperability
- Support for Broadband Services
- Low Transmission Costs
- Aggregation of Traffic
  - Voice
  - Data
  - Video
  - Image
- Simplicity of Multiplexing
  - ADMs and OADMs
- Reduced Delay
- Network Management
- Extendible to Premise

SDN/SONET: Applications

- Carrier Backbone Networks
- Converged Public Networks
- Campus Environments
- Mission-Critical Environments
- Bandwidth-Intensive Local Loops

Wavelength Division Multiplexing

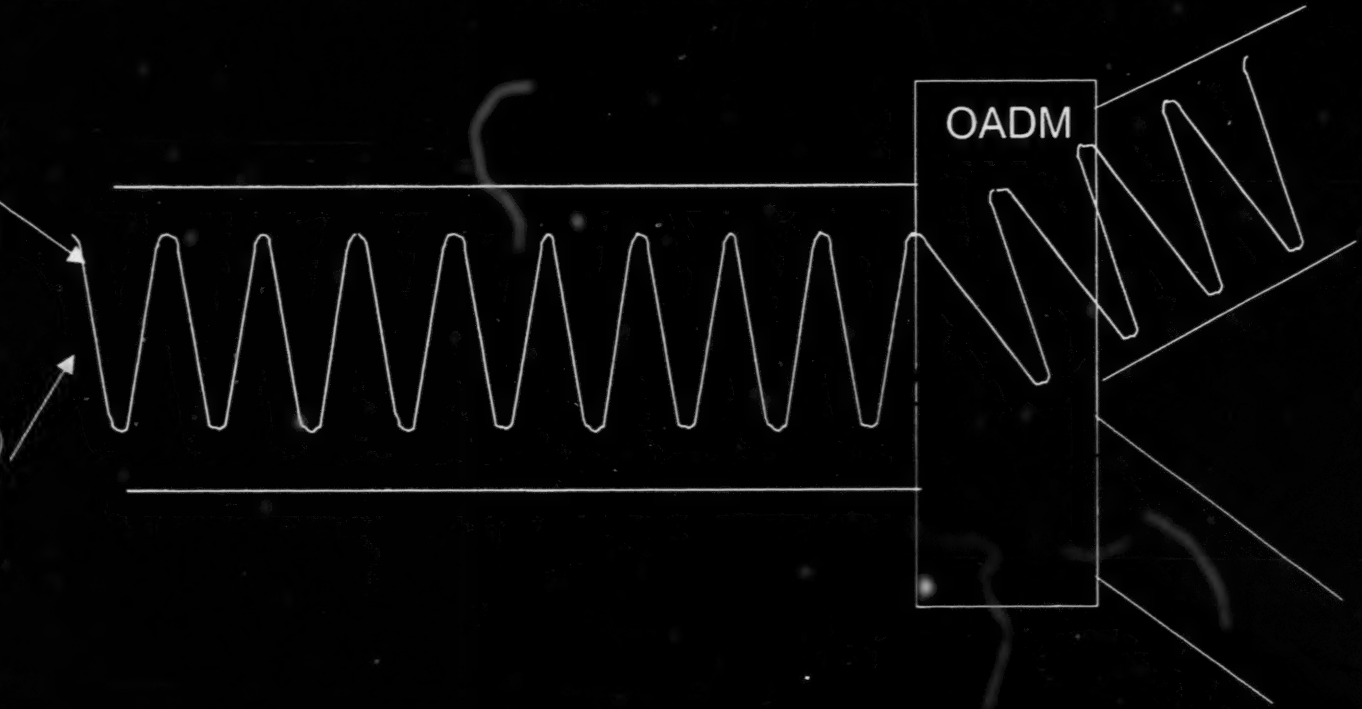


≤ OC- 192
≤ 10 Gbps

≤ OC - 192
≤ 10 Gbps

BEST COPY AVAILABLE

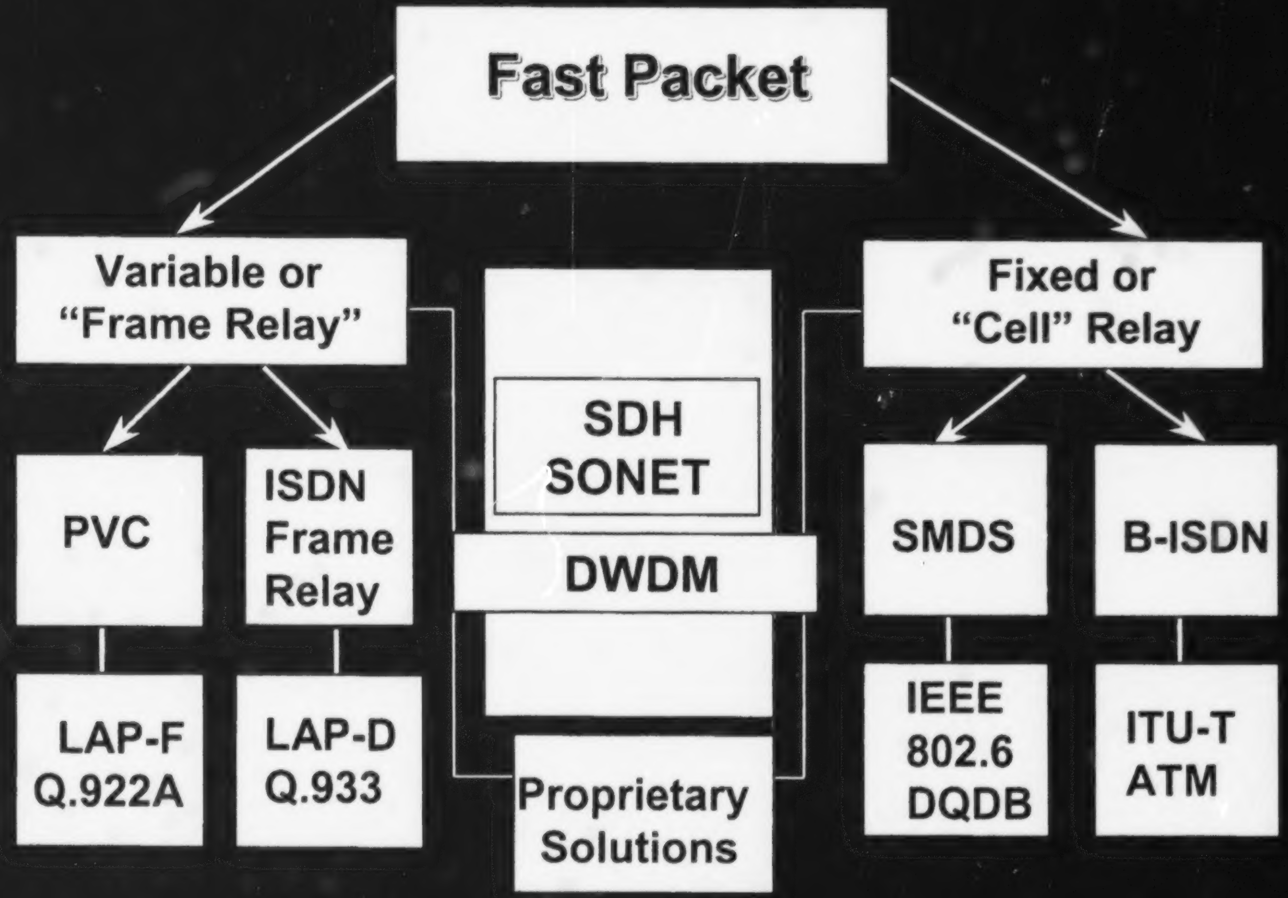
Optical Add/Drop Multiplexing



≤ OC- 192
≤ 10 Gbps

≤ OC - 192
≤ 10 Gbps

Broadband Services



Fast Packet

Variable or "Frame Relay"

PVC

LAP-F Q.922A

ISDN Frame Relay

LAP-D Q.933

SDH SONET

DWDM

Proprietary Solutions

Fixed or "Cell" Relay

SMDS

IEEE 802.6 DQDB

B-ISDN

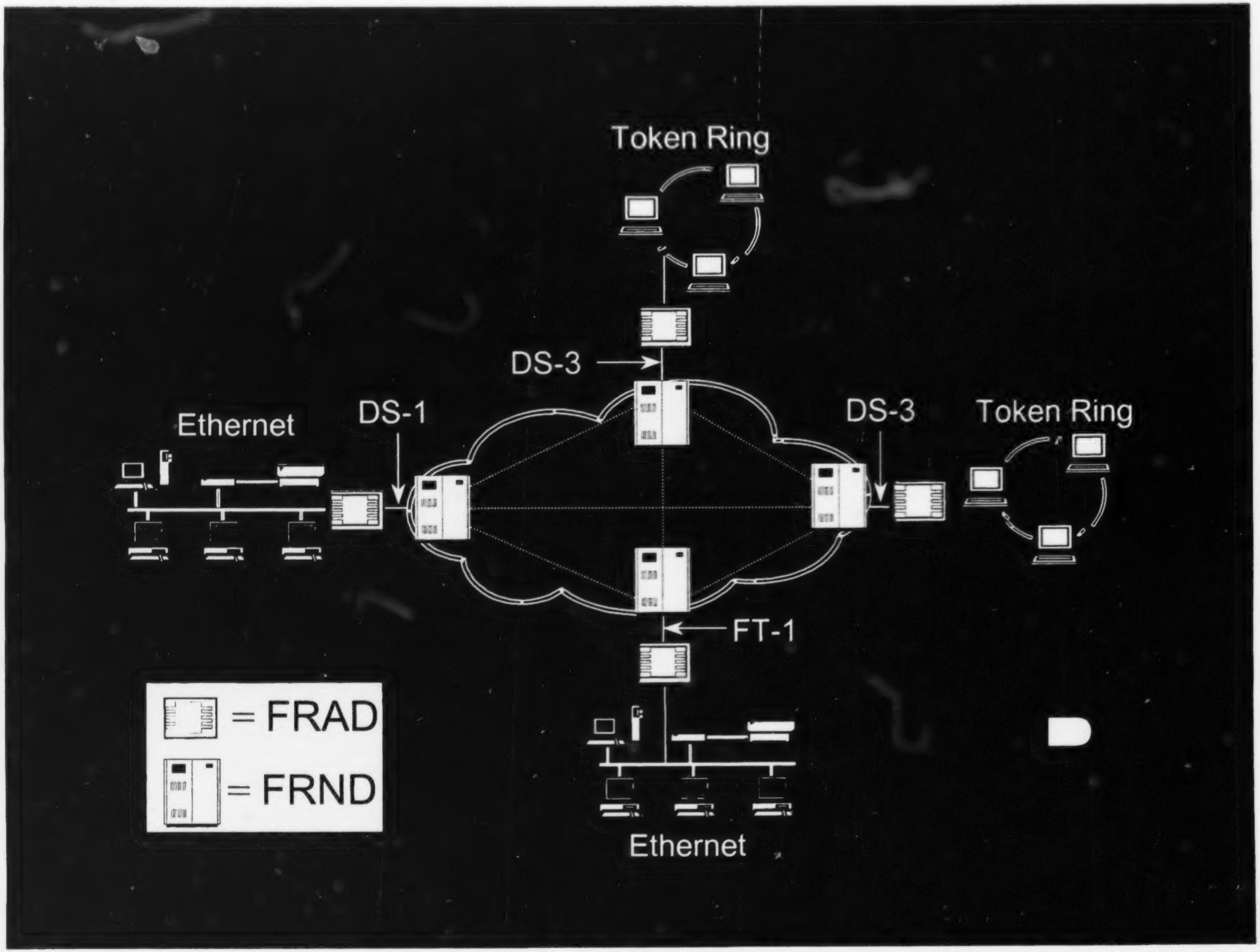
ITU-T ATM

Frame Relay Defined

Frame Relay is an interface standard defined by ANSI and the ITU-T. Access to the Frame Relay network is accomplished using the LAP-D protocol developed for ISDN and at rates of 56 Kbps, DS-1 or DS-3. Frame Relay is a connection-oriented service. Error control is the responsibility of the user.

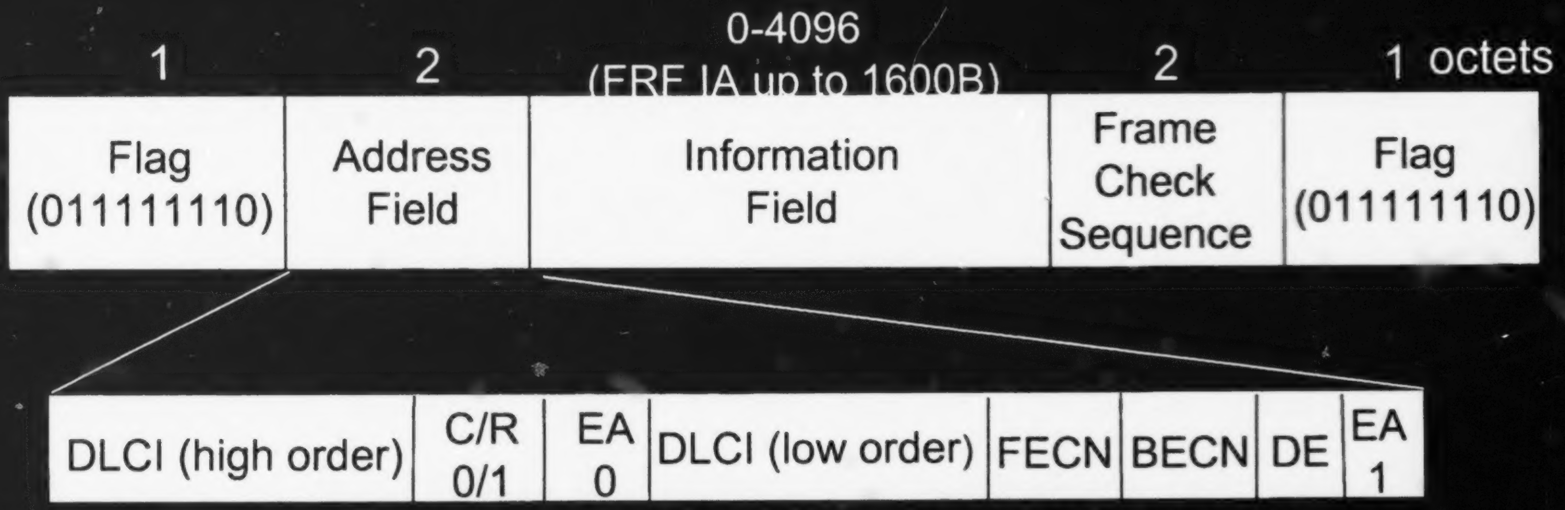
X.25/Frame Relay Comparison

• Analog Facilities	• Digital Facilities
• Fixed Payload	• Variable Payload
• Speed up to DS-1	• Speed up to T-3
• LAP-B	• LAP-D
• High Latency	• Moderate Latency
• Connection-Oriented	• Connection-Oriented
• Error Control	• No Error Control
• Protocol Conversion	• No Protocol Conversion
• Interactive Data	• LAN-to-LAN


Token Ring
DS-3
Ethernet
DS-1
DS-3
Token Ring
FT-1
= FRAD
= FRND
Ethernet

Frame Relay Network

- User Network Interface (UNI)
  - FRAD and FRND
- Network-to-Network Interface (NNI)
  - Interface Between Frame Relay Networks
- Access Links Based on ISDN
- Permanent Virtual Circuits (PVCs)
- Switched Virtual Circuits (SVCs)
- Mesh Networking
- Network Processing


1
2
0-4096
(FRF IA up to 1600B)
2
1 octets
Flag (011111110)
Address Field
Information Field
Frame Check Sequence
Flag (011111110)
DLCI (high order)
C/R 0/1
EA 0
DLCI (low order)
FECN
BECN
DE
EA 1

Address Field Format - 2 octets (default)

Notes:
DLCI: Data Link Connection Identifier
C/R: Command/Response Field
FECN: Forward Explicit Congestion Notification
BECN: Backward Explicit Congestion Notification
DE: Discard Eligibility
EA: Address Field Extension

Frame Relay: Congestion Management

- Access Rate
- Measurement Interval (T)
- Burst Size (B_c)
- Excess Burst Size (B_e)
- Discard Eligibility (DE)
- Offered Load
- Explicit Congestion Notification (ECN)
- Implicit Congestion Notification (ICN)

Congestion Control Algorithms

• Closed-Loop	• Open-Loop
Accept frames only if extremely high probability of successful delivery. Fair allocation of bandwidth among PVCs, and in proportion to CIRs	Accept all frames with no prior knowledge of the likelihood of their successful delivery

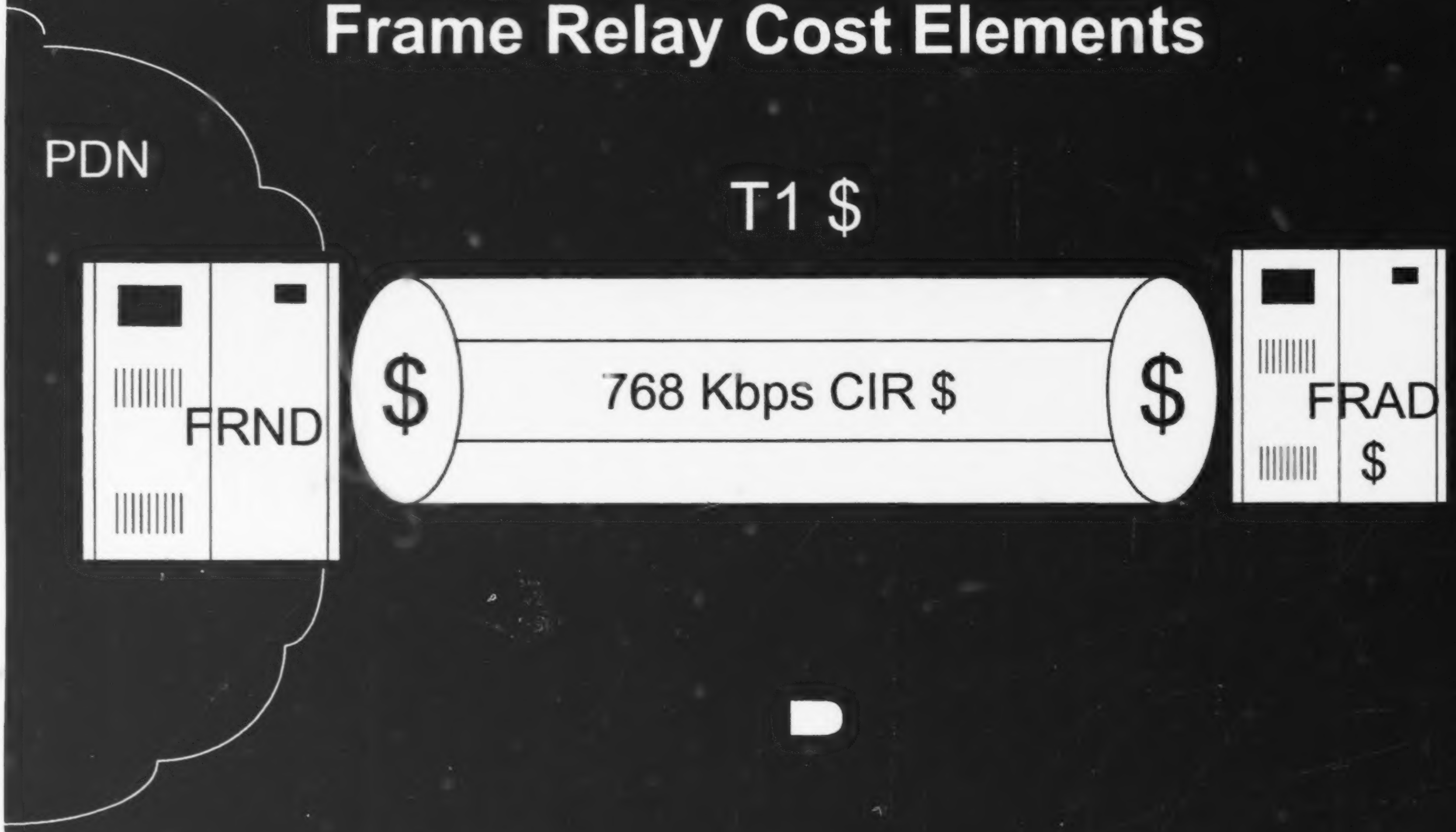
Frame Relay QoS: Work in Progress

- Real Time Variable Frame Rate
  - Committed Bandwidth, Low Delay, Low Loss
  - Compressed Voice, SNA, other Delay-Sensitive Traffic
- Non-Real Time Variable Frame Rate
  - Committed Bandwidth, Moderate Delay, Low Loss
  - LAN-to-LAN, Business-Class Internet/Intranet Traffic
- Available/Unspecified Frame Rate
  - Best-Effort, Using Any Remaining Bandwidth
  - E-Mail, File Transfer, Residential/Small Business Internet

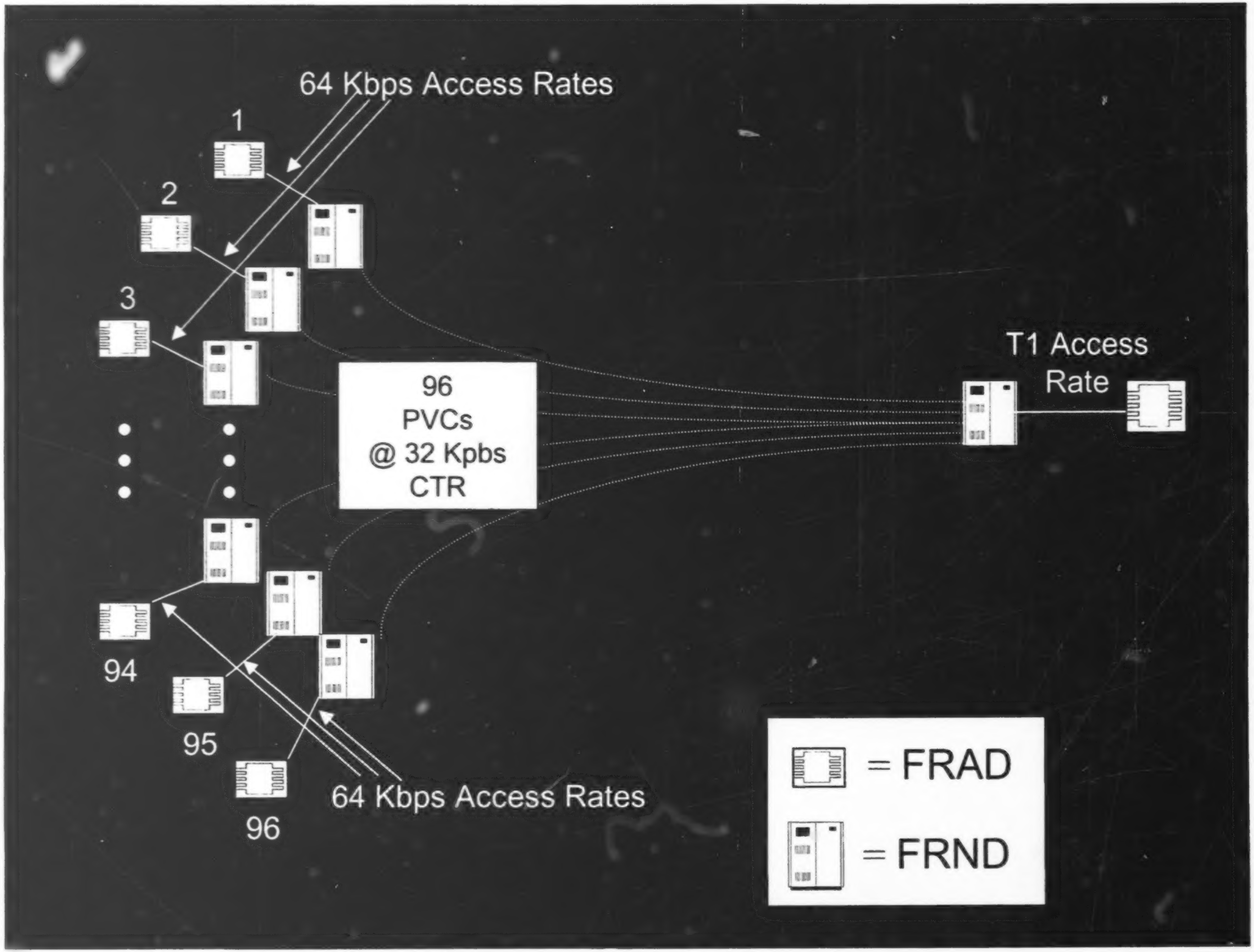
Frame Relay:
Costs

- Port Charge, Bandwidth-Sensitive
- Access Line
  - Bandwidth-Sensitive
  - Distance-Sensitive
- Committed Information Rate (CIR)
- Burst Size (B_c), Time Sensitive
- Network-to-Network Interface (NNI)
- Back-up PVCs (Discounted)

Frame Relay Cost Elements


PDN
T1 $
FRND
$
768 Kbps CIR $
$
FRAD
$

BEST COPY AVAILABLE



64 Kbps Access Rates

1

2

3

94

95

96

64 Kbps Access Rates

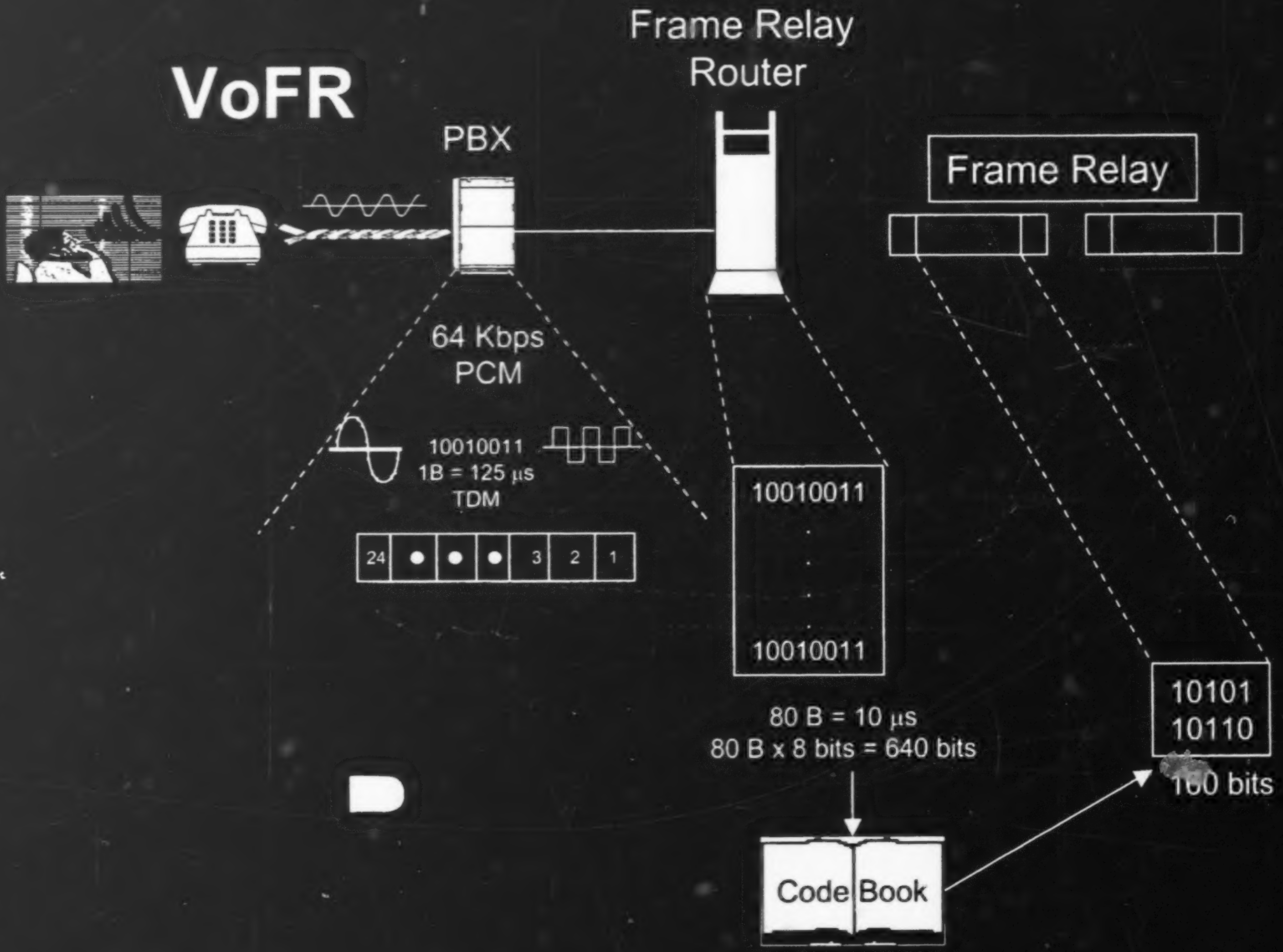
96
PVCs
@ 32 Kpbs
CTR

T1 Access
Rate

= FRAD

= FRND

VoFR


PBX
Frame Relay Router
Frame Relay
64 Kbps
PCM
10010011
1B = 125 µs
TDM
24
3
2
1
10010011
10010011
80 B = 10 µs
80 B x 8 bits = 640 bits
Code Book
10101
10110
160 bits

Voice over Frame Relay (VoFR) Compression Is The Key

- **G.711**
  - PCM
  - 64 Kbps; 0.75ms
  - MOS 4.4
- **G.723**
  - H.324 Umbrella
  - 6.3 & 5.3 Kbps; 30.0ms
  - MOS 3.5-3.98
- **G.726 (FRF.11)**
  - ADPCM
  - 40,32,24,16 Kbps; 1.0ms
  - MOS 4.2
- **G.728**
  - LD-CELP
  - 16 Kbps; 3.0-5.0ms
  - MOS 4.2
- **G.729 (FRF.11)**
  - CS-ACELP
  - 8 Kbps; 10.0ms
  - MOS 4.2

Voice over Frame Relay (VoFR)

Advantages

- Low Cost
  - Integrated Voice/Data (Voice Rides for FREE!)
  - Distance-Insensitive

Disadvantages

- Quality: Questionable and Variable
- Lack of Standards
- Additional Cost
  - PBX Interface
  - PVCs
  - Increased CIRs
  - Voice FRAD

Frame Relay: Advantages

- Support for Bandwidth-Intensive Applications
- Protocol-Insensitive
- Virtual Private Network (VPN)
- Cost-Effective Replacement for Leased Lines
- Costs
  - Scalable
  - Distance-Insensitive
- Bandwidth-on-Demand
- Backward-Compatibility
- Dial-up Access for Telecommuters
- Public and Private Technology

Frame Relay: Disadvantages

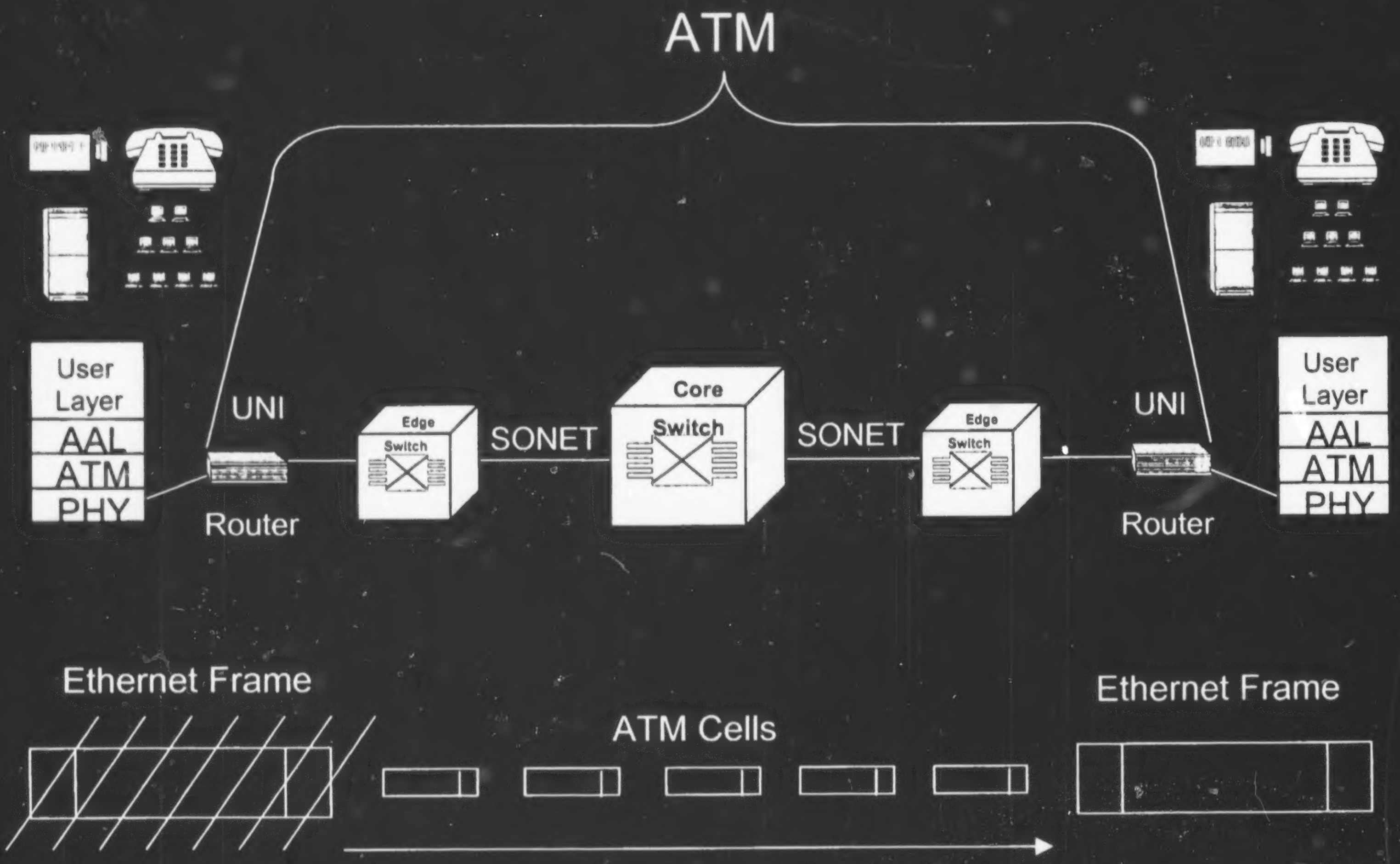
- Digital Local Loop Required
- Ineffective Support for Voice & Video
- Latency Moderate
- SVC Availability
- PVCs Require Backup
- Congestion Management Poor
- Carrier Internetworking not End-to-End
- Multicasting not Fully Supported

Frame Relay: Applications

- Data
  - LAN Internetworking
  - LAN-to-Host
  - Controller-to-Host
  - Host-to-Host
- Image Networking
- Low-Speed Video (Poor)
- Voice (Poor)

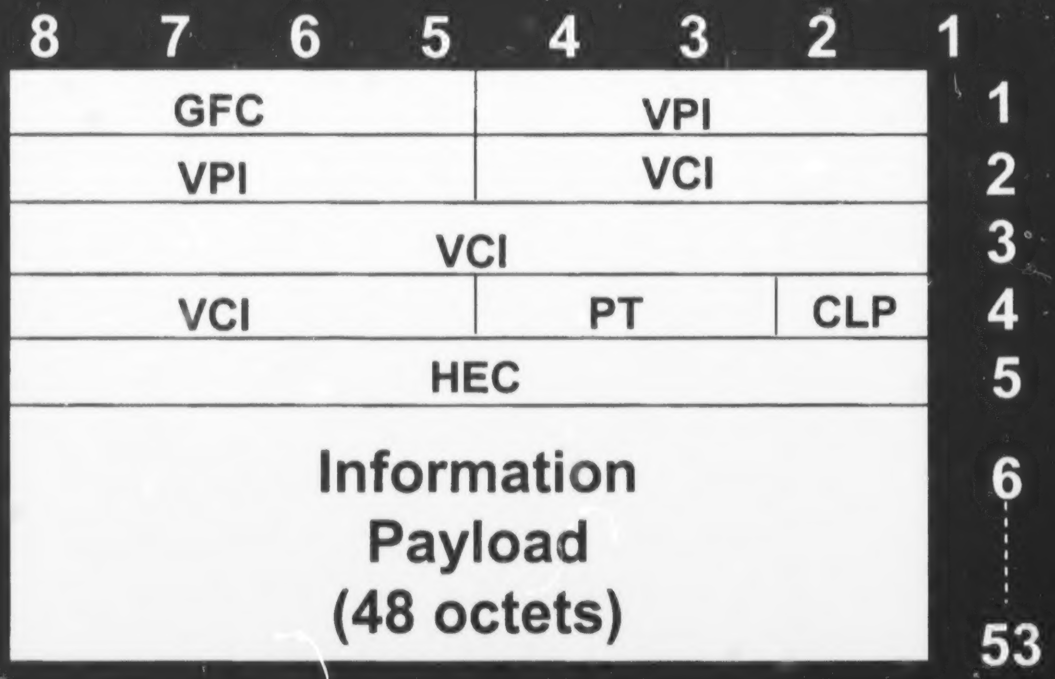
Asynchronous Transfer Mode (ATM)

ATM is a fast-packet, connection-oriented cell-switching technology for broadband communications; fixed length cell of 53 octets is standard. Access generally is at speeds of DS-1 (I.5 Mbps) up to OC-12 (622 Mbps). ATM is generally thought of as a backbone network technology, although it has application on the premise, as well.


ATM
User
Layer
AAL
ATM
PHY
UNI
Router
Edge
Switch
SONET
Core
Switch
SONET
Edge
Switch
UNI
Router
User
Layer
AAL
ATM
PHY
Ethernet Frame
ATM Cells
Ethernet Frame

Segmentation And Reassembly

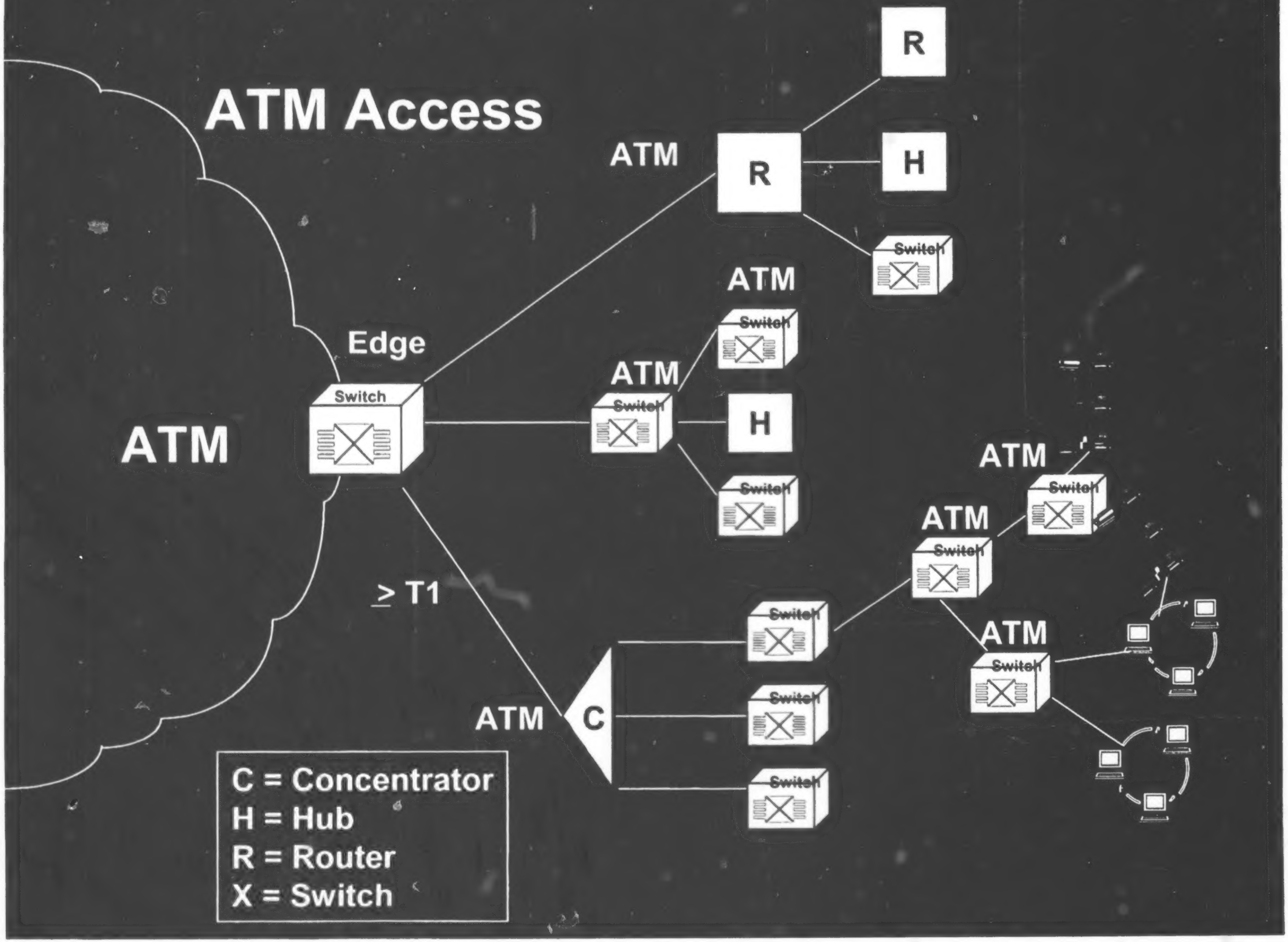
ATM Cell Format



8	7	6	5	4	3	2	1	Octet
GFC				VPI				1
VPI				VCI				2
VCI								3
VCI				PT			CLP	4
HEC								5
Information Payload (48 octets)								6 53

Notes:
GFC: Generic Flow Control
VPI: Virtual Path Identifier
VCI: Virtual Channel Identifier
PT: Payload Type
CLP: Cell Loss Priority
HEC: Header Error Control

ATM Access


ATM
Edge
Switch
ATM
R
R
H
Switch
ATM
ATM
Switch
Switch
H
Switch
> T1
ATM
C
Switch
Switch
Switch
ATM
Switch
ATM
Switch
ATM
Switch

C = Concentrator
H = Hub
R = Router
X = Switch

ATM Adaptation Layers (AALs)

- **AAL Type 1: Class A Traffic**
  - Connection-Oriented; CBR; Timed; VP/VC
- **AAL Type 2: Class B Traffic**
  - Connection-Oriented; rt-VBR; Timed; VP/VC
- **AAL Type 3/4: Class C or Class D Traffic**
  - nrt-VBR; Not Timed
  - Message Mode or Streaming Mode
- **AAL Type 5: Class C & X Traffic**
  - Class C: VBR, Not Timed
  - Class C: Message Mode, Only
  - Class X: UBR/ABR
  - Class X: LANE, IP

ATM QoS: Service Categories

- Constant Bit Rate (CBR)
- Real-Time Variable Bit Rate (rt-VBR)
- Non Real-Time Variable Bit Rate (nrtVBR)
- Unspecified Bit Rate (UBR)
- Available Bit Rate (ABR)

Constant Bit Rate (CBR)

- Continuous Data Flow
- Intolerant of Loss and Delay
- Traffic Parameters: PCR, CDVT
- QoS Parameters: CDV, CTD, CLR
- Applications: Uncompressed
  - Voice
  - Audio
  - Video

Real-Time Variable Bit Rate (rt-VBR)

- Bursty
- Data Integrity: Timing and Control
- Traffic Parameters: PCR, CDVT, SCR, MBS, BT
- QoS Parameters: CLR
- Applications: Compressed
  - Voice
  - Audio
  - Video

Non Real-Time Variable Bit Rate (nrt-VBR)

- Bursty
- Tolerant of Delay and Loss
- Traffic Parameters: PCR, CDVT, SCR, MBS, BT
- QoS Parameters: CLR
- Applications: Compressed
  - X.25, Frame Relay, SMDS, LAN-to-LAN
  - Transaction Processing
  - nrt, Buffered Voice and Video

Unspecified Bit Rate (UBR)

- Best Effort
- Traffic Parameters: PCR, CDVT
- QoS Parameters: None
- Applications:
  - File Transfer
  - E-Mail

Available Bit Rate (ABR)

- Best Effort
- VBR with Flow Control, Minimum Transmission Rate, Specified Performance Parameters
- Traffic Parameters: PCR, CDVT, MCR
- QoS Parameters: None
- Applications: Not Real Time

ATM Performance Parameters: Accuracy, Dependability & Speed

- Cell Delay Variation (CDV)
- Cell Error Ratio (CER)
- Cell Loss Ration (CLR)
- Cell Misinsertion Rate (CMR)
- Cell Transfer Delay (CTD)
- Severely errored Cell Block Ratio (SECBR)

ATM Traffic Contract:
Negotiated Between Source Endpoint and Network

- Peak Cell Rate (PCR)
- Sustainable Cell Rate (SCR)
- Maximum Burst Size (MBS)
- Minimum Cell Rate (MCR)

ATM Applications

- Point-to-Point
- Point-to-Multipoint Conferencing
  - Video
  - Multimedia
- Data Networking (LAN, MAN, WAN)
- Image Networking
- Video (Future)
- Voice (Future)

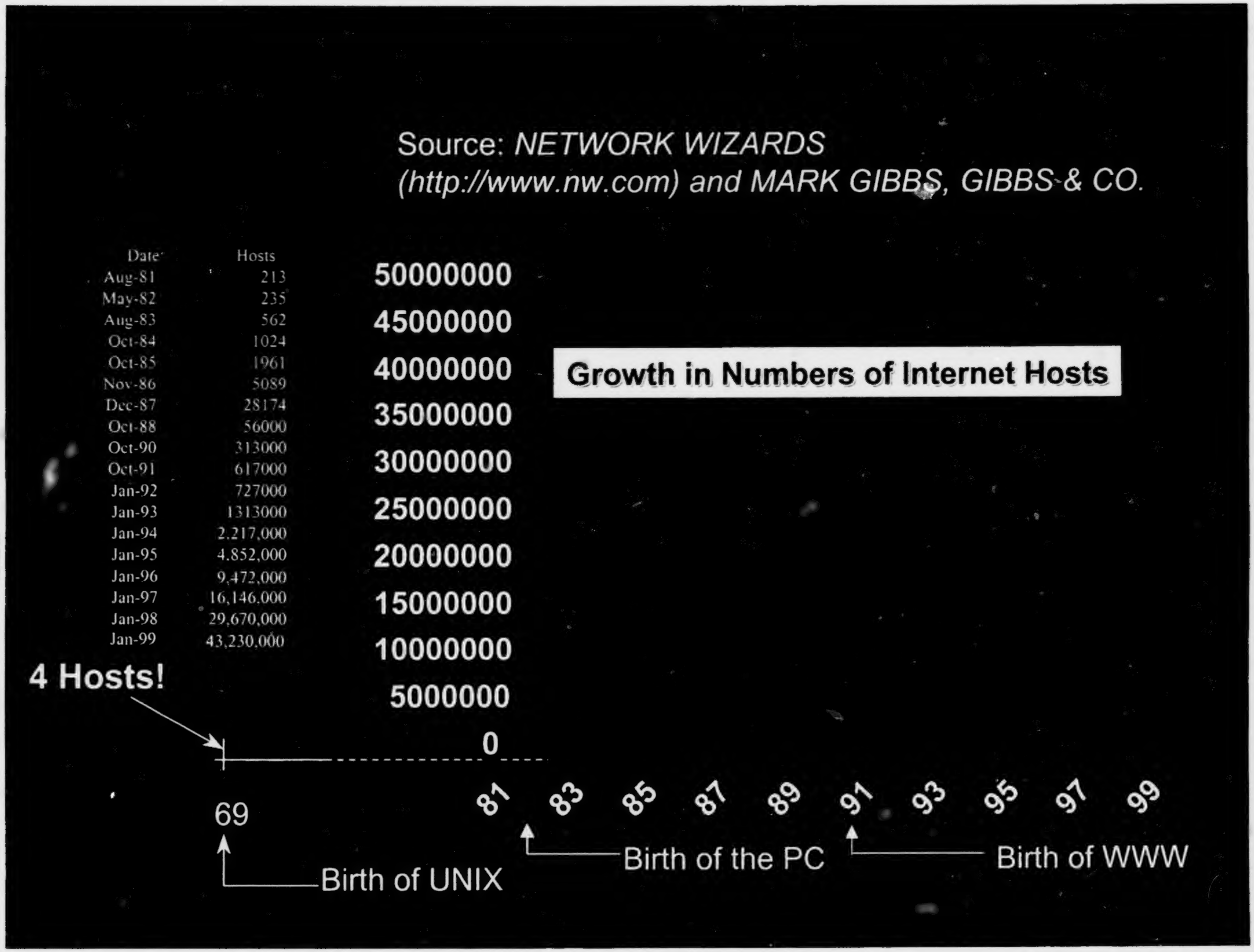
ATM Advantages

- Digital
- High Bandwidth
- Bandwidth-on-Demand
- Any-to-Any Connectivity
- Mesh Networking
- High Throughput
- Error Performance
- Access Control
- Congestion Control
- Protocol-Independent

- Supports Async, Sync and Isoc Traffic
- Supports Data, Image, Voice and Video
- Interconnection to X.25, Frame Relay, SMDS
- Network Reconfiguration Simplified
- Scalable
- Software Upgrade to CPE
- Private Network Option
- Supports B-ISDN

ATM Disadvantages

- Limited Availability
- Forklift Upgrade
  - Equipment
  - Technical Support
- Voice and Video Not Compelling
  - Except in Backbone
- Expensive
- Technically Demanding



Growth in Numbers of Internet Hosts

Source: *NETWORK WIZARDS (http://www.nw.com)* and *MARK GIBBS, GIBBS & CO.*

Date	Hosts
Aug-81	213
May-82	235
Aug-83	562
Oct-84	1024
Oct-85	1961
Nov-86	5089
Dec-87	28174
Oct-88	56000
Oct-90	313000
Oct-91	617000
Jan-92	727000
Jan-93	1313000
Jan-94	2,217,000
Jan-95	4,852,000
Jan-96	9,472,000
Jan-97	16,146,000
Jan-98	29,670,000
Jan-99	43,230,000

4 Hosts!

Birth of UNIX

Birth of the PC

Birth of WWW

MAE
New York

MAE-West
NAP
San Francisco

MAE
Los Angeles

MAE Dallas

MAE Houston

MAE-East
Washington, DC

NAP
New Jersey

MAE
NAP
Chicago

IX
Amsterdam Internet
Exchange (AMS-IX)

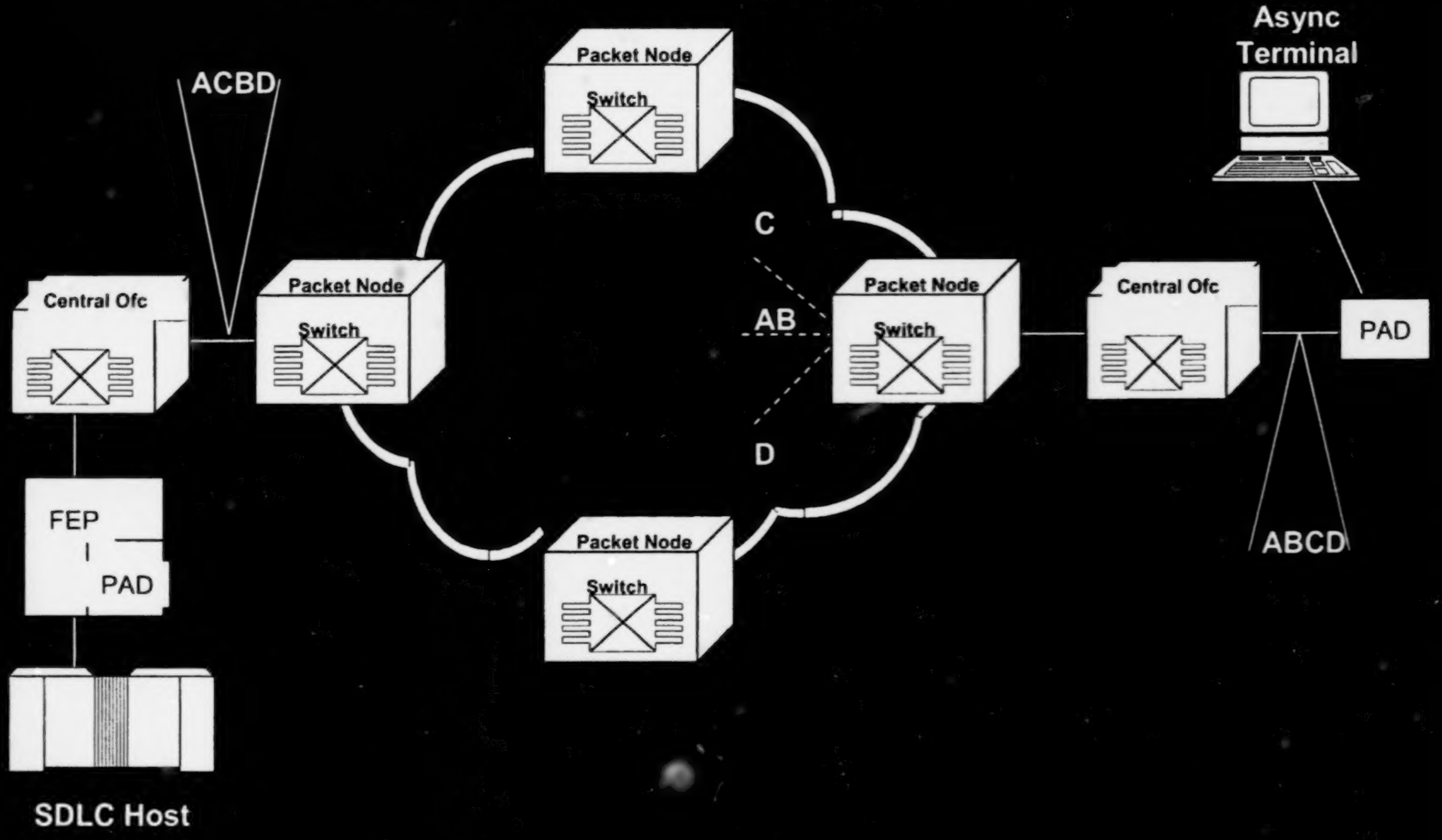
IX
London Internet
Exchange (LINX)

IX
Service for French
Internet Exchange
(SFINX)

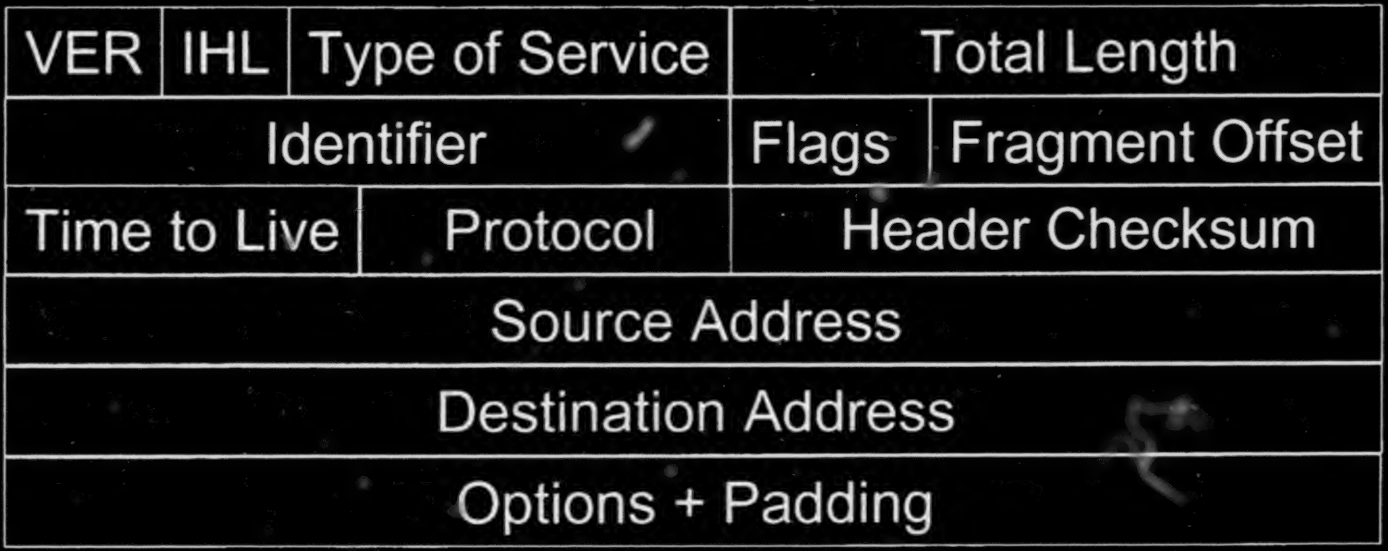
IX
Hong Kong
Internet Exchange
(HKIX)

IX
Japan
Internet
Exchange
(JPIX)

IP: Connectionless Delivery


Async Terminal
PAD
ABCD
Central Ofc
Packet Node
Switch
C
AB
D
Packet Node
Switch
Packet Node
Switch
Packet Node
Switch
ACBD
Central Ofc
FEP
PAD
SDLC Host

IPv4



VER | IHL | Type of Service | Total Length

Identifier | Flags | Fragment Offset

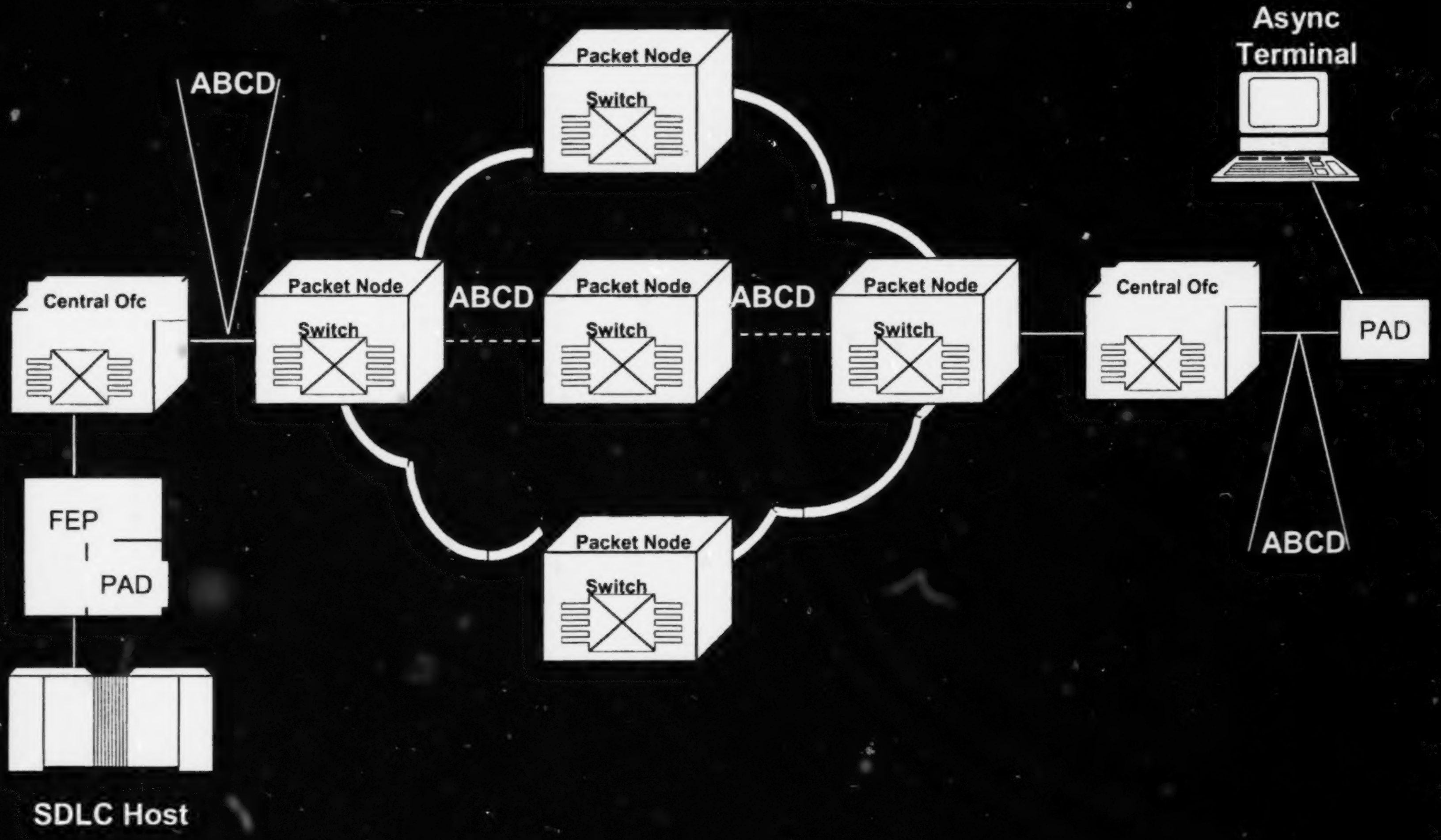
Time to Live | Protocol | Header Checksum

Source Address

Destination Address

Options + Padding

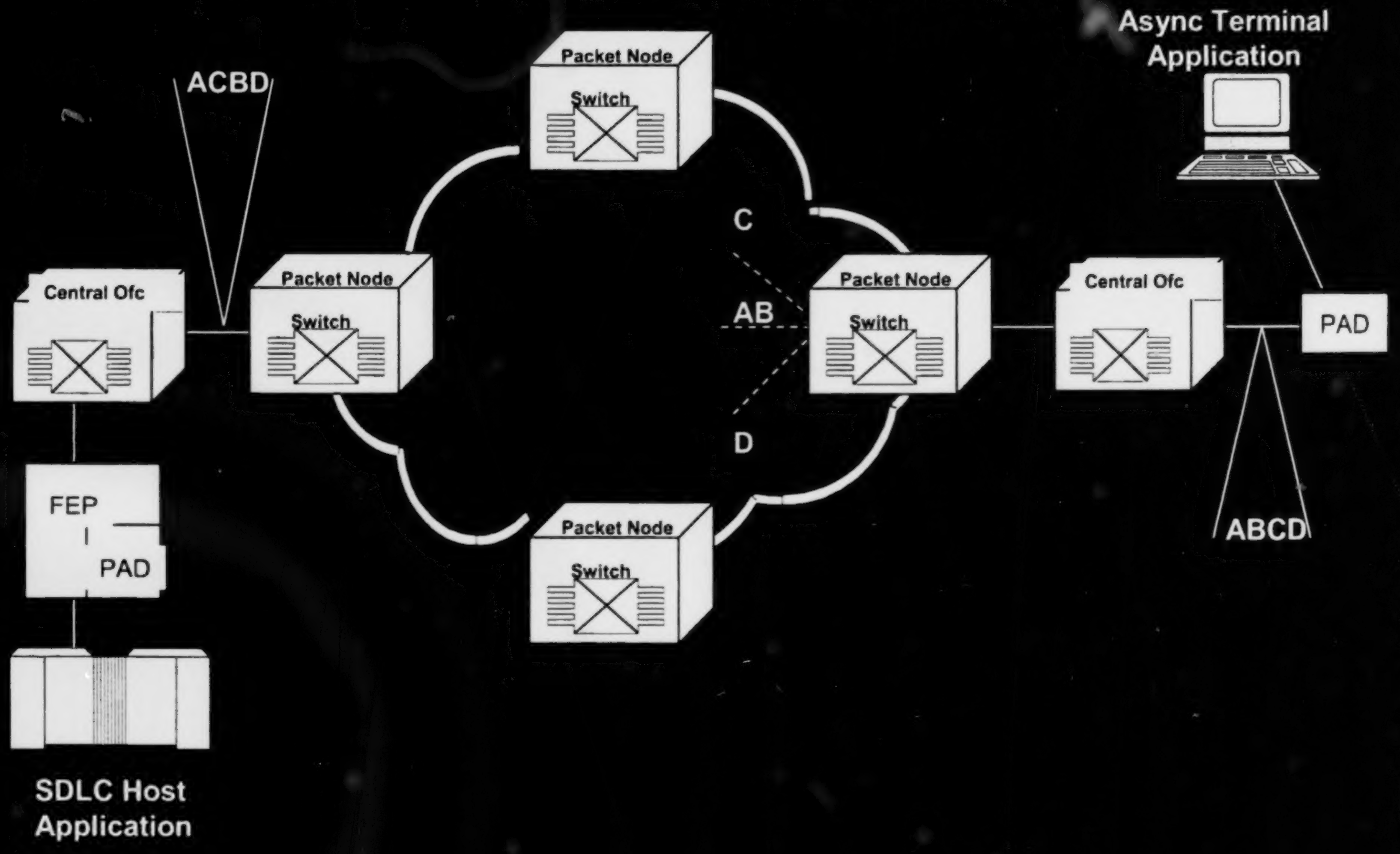
TCP: Connection-Oriented


Async
Terminal
PAD
ABCD
Central Ofc
Packet Node
Switch
ABCD
ABCD
ABCD
FEP
PAD
SDLC Host

TCP

<table>
<tr><td colspan="3">SOURCE PORT</td><td colspan="2">DESTINATION PORT</td></tr>
<tr><td colspan="5">SEQUENCE NUMBER</td></tr>
<tr><td colspan="5">ACKNOWLEDGEMENT NUMBER</td></tr>
<tr><td>HLEN</td><td>RESERVED</td><td>CODE BITS</td><td colspan="2">WINDOW</td></tr>
<tr><td colspan="3">CHECKSUM</td><td colspan="2">URGENT POINTER</td></tr>
<tr><td colspan="4">OPTIONS (IF ANY)</td><td>PADDING</td></tr>
<tr><td colspan="5">DATA</td></tr>
<tr><td colspan="5">. . .</td></tr>
</table>

UDP: Connectionless Delivery


Async Terminal Application
ACBD
Packet Node
Switch
C
AB
D
Central Ofc
PAD
ABCD
FEP
PAD
SDLC Host Application

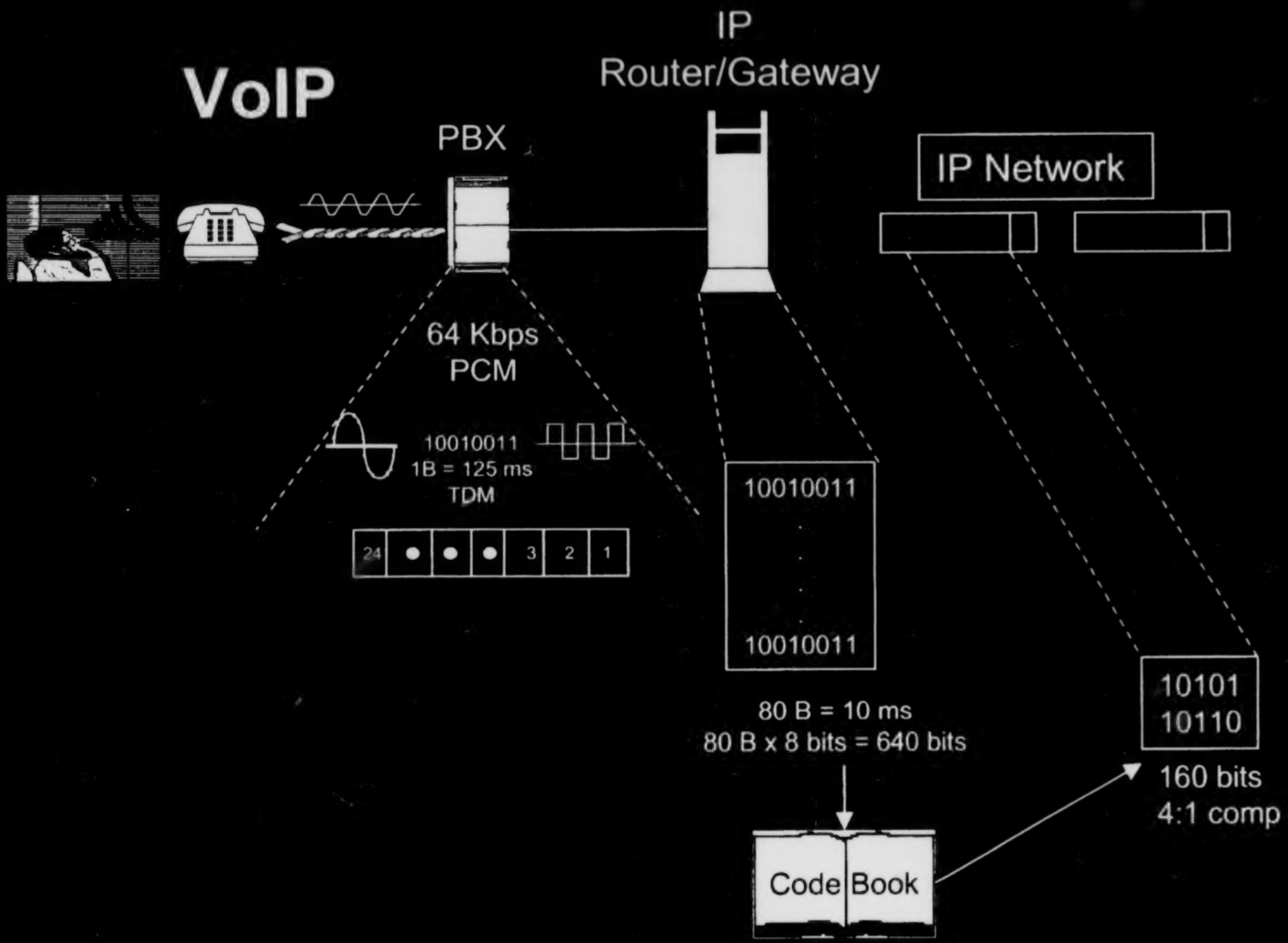
UDP

UDP SOURCE PORT	UDP DESTINATION PORT
UDP MESSAGE LENGTH	UDP CHECKSUM
DATA	
. . .	

Application-Level Protocols

- Telecommunications Network (TELNET)
- File Transfer Protocol (FTP)
- Simple Mail Transfer Protocol (SMTP)
- Simple Network Management Protocol (SNMP)

VoIP



PBX

IP
Router/Gateway

IP Network

64 Kbps
PCM

10010011
1B = 125 ms
TDM

24 ● ● ● 3 2 1

10010011
.
.
10010011

80 B = 10 ms
80 B x 8 bits = 640 bits

Code Book

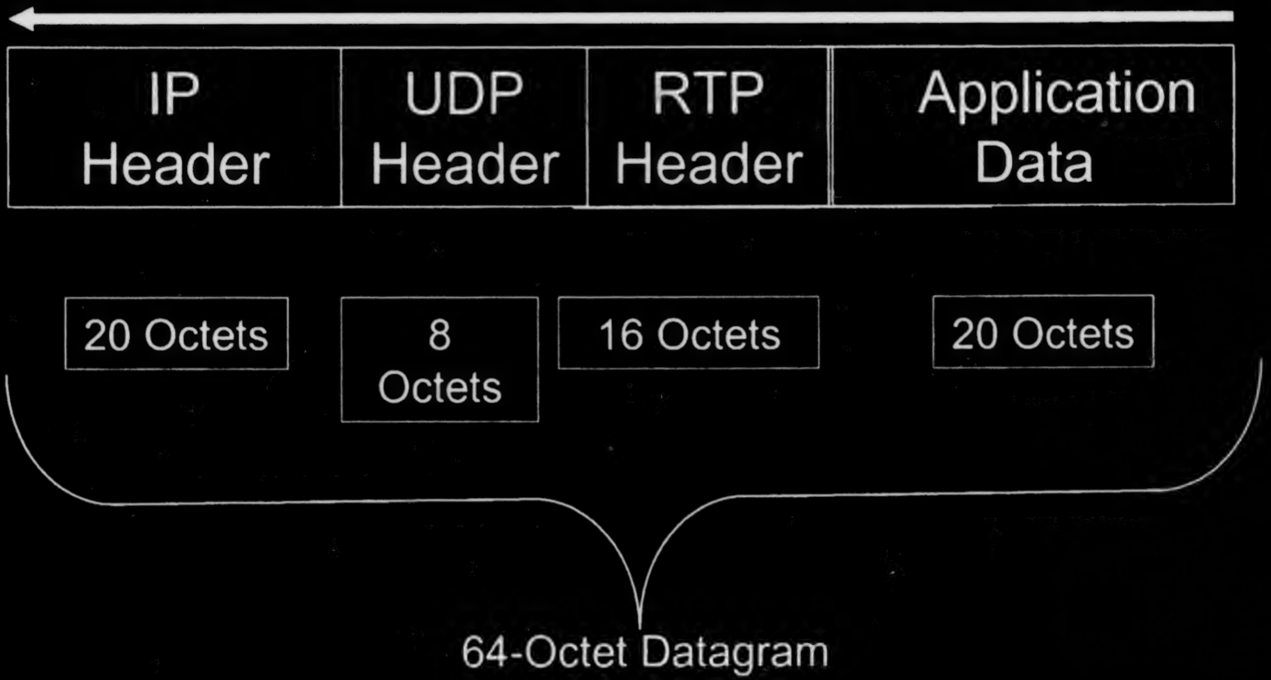
10101
10110

160 bits
4:1 comp

VoIP:
Compression Is The Key

- **G.711**
  - PCM
  - 64 Kbps; 0.75ms
  - MOS 4.4
- **G.723**
  - H.324 Umbrella
  - 6.3 & 5.3 Kbps; 30.0ms
  - MOS 3.5-3.98
- **G.726 (FRF.11)**
  - ADPCM
  - 40,32,24,16 Kbps; 1.0ms
  - MOS 4.2
- **G.728**
  - LD-CELP
  - 16 Kbps; 3.0-5.0ms
  - MOS 4.2
- **G.729 (FRF.11)**
  - CS-ACELP
  - 8 Kbps; 10.0ms
  - MOS 4.2

VoIP Transmission Framing



IP Header

UDP Header

RTP Header

Application Data

20 Octets

8 Octets

16 Octets

20 Octets

64-Octet Datagram

VoIP

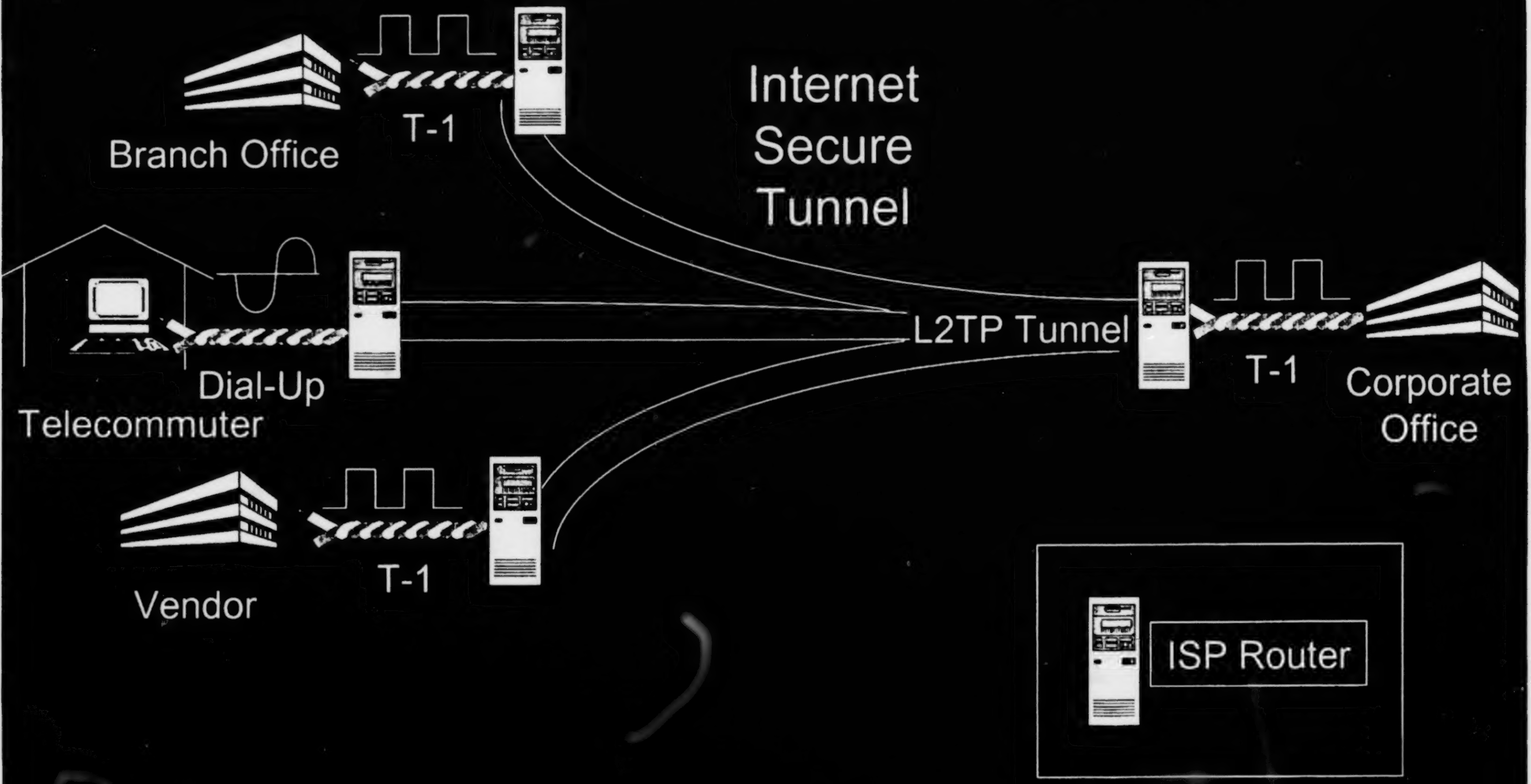
Advantages

- Low Cost
  - Integrated Voice/Data (Voice Rides for FREE?)
  - Distance-Insensitive

Disadvantages

- Quality: Questionable and Variable
- Lack of Standards
- Additional Cost
  - Gateway

Virtual Private Network (VPN)


Branch Office
T-1
Internet
Secure
Tunnel
Dial-Up
Telecommuter
L2TP Tunnel
T-1
Corporate
Office
Vendor
T-1
ISP Router

Virtual Private Network (VPN)

- Authentication
- Encryption
- Tunneling
  - SOCKSv5
  - Point-to-Point Tunneling Protocol (PPTP)
  - Layer 2 Tunneling Protocol (L2TP)

Virtual Private Network (VPN)

Application Scenarios

- Remote Access
- Intranet
- Extranet

Workshops & Roundtables

Sunday 14 January 2001
0900–1200

Workshops

WKS2 Joint Ventures and Strategic Alliances in Asia: Convergence and Consolidation

Location: South Pacific I

Moderator:

PHILLIP L. SPECTOR, Partner & Chair, Communications & Technology Practice Group, Paul, Weiss, Rifkind, Wharton & Garrison (PWRW&G), *USA*

Panelists:

JEANETTE K. CHAN, Partner, PWRW&G, *Hong Kong*

SAMUEL SOON-YUB KWON, Executive Vice President, Chief New Business Officer, and General Counsel, Hansol PCS Co., Ltd., Seoul, *South Korea*

LIONEL OLMER, Partner, PWRW&G, *Japan*

MICHAEL REEDE, Partner, PWRW&G, *Hong Kong*

This workshop will focus on the practical, "hands-on" aspects of forming transnational joint ventures and strategic alliances in the telecommunications and information industries. After an overview of issues common to all such alliances, the workshop will provide a country-specific analysis with respect to three major Asian nations: China (including Hong Kong), Japan, and Korea. The emphasis will be on the practical– the "how to" and "with whom", and there will also be discussion of both financial and legal issues.

back

Sunday 14 January 2001
0900–1200

Workshops

WKS3 Buying and Selling Telecoms Services Through Centralized Exchanges

Location: South Pacific III

Moderator:

PAULA BRILLSON, Executive Chairman and Founder, Asia Capacity Exchange, *Hong Kong SAR China*

Panelists:

MARK GILROY, President, Asia Pacific, Loral Cyberstar, *Singapore*

ANDREW D. LIPMAN, Partner, Swidler, Berlin, Sheriff, Friedman, *USA*

GREGG DAFFNER, Chief Strategic Officer, Q-East, *USA*

PETER LORD, Associate, Morgan Stanley Dean Witter, *USA*

JEFF STARK, Executive Vice President, Sales & Marketing, The GTX, *USA*

FRED COHAGEN, Manager, Broadband Services, *USA*

Panelists will discuss how telecom exchanges have benefited market participants including capacity providers, telecom companies and ISPs. Interactive discussions will be held on how participants see the marketplace evolving to include trading of applications/content. Panelists will discuss future opportunities for trading megabits as derivative products and how this will benefit industry participants. The focus of the workshop will be to cover the practical aspects of on-line trading and there will also be discussion of technical, financial and legal issues of bandwidth trading transactions.

back

Sunday 14 January 2001
1300–1600

Roundtables

RT1 Future Scenarios for the Submarine Cable Industry

Location: Tapa I

Moderator: STEPHEN MCCLELLAND, Editorial Director, International Operations, Telecommunications (R) International, *United Kingdom*

As global demand for bandwidth has burgeoned, the fiberoptic submarine cable industry has moved to centre-stage in the international telecom industry. PTC2001 represents a unparalleled opportunity to bring together the key figures in the operator, vendor and support environments to debate the future shape of this industry.

To maximize the quality and degree of debate, this year, the session will adopt a new format. In the session will be:

- Rapid response question and answer
- The introduction of 4 prepared scenarios suggesting possible future outcomes for the submarine cable industry to stimulate debate
- The appearance of 'expert witnesses' to help in cross-examination.

Participants

EDWARD McCORMACK, Chief Operating Officer, FLAG Telecom Ltd., *United Kingdom*

SATOSHI FUJITA, Senior Vice President, Global Business Development, NTT Communications, *Japan*

JEAN GODELUCK, Chief Executive Officer, Alcatel Submarine Networks, *France*

JOHN HIBBARD, Managing Director, International Carrier Business, Telstra, *Australia*

CHARLES JARVIE, Manager, Strategic Development, Telecom New Zealand, *New Zealand*

ALAN LOWE, Chief Executive Officer, I-21 Future Communication

ALAN ROBINSON, Director, Capacity Management, C&W Global Network, *United Kingdom*

BRIAN ROUSSELL, Vice President, Global Sales and Marketing, Tycom, *USA*

JOHN TIBBLES, Vice President, International Network Development, WorldCom, *USA*

COLIN WILLIAMS, Chief Executive Officer, Level 3,

Expert Witnesses

THOMAS SOJA, Chief Executive Officer, Thomas Soja & Associates, *USA*

JEAN DEVOS, Chief Executive Officer, Axone, *France*

Key Topic Discussions

Can the industry continue to enjoy endless success? What are the limiting factors in this business? Is bandwidth unit pricing falling off a cliff? What defines the supply function, what the operating function? Can suppliers become operators? When are there conflicts of interests? Is there a balance of power? Has the Internet redefined all future ways of international connectivity? What part does the US play in international connectivity? Is it causing sharply directional traffic characteristics in global networks, and is this a major concern? Can the industry - in its optimism - overbuild? What will be the balance of operator-funded projects versus private ones? How will operations support be structured in future cable projects?

back

Sunday 14 January 2001
1300–1600

Roundtables

RT2 The Economics of International Internet Bandwidth: The ICAIS Debate

Location: Honolulu Suite

Moderator: JAMES SAVAGE, President and CEO, Raincoast Group, *Canada*

This Round Table provides an open forum on one of the most controversial topics in the broadband world: Will governments impose a 'telecommunications-style' accounting rate and settlement structure for the Internet? Proponents argue that the current free-for-all favours North American ISPs and Carriers, and that without such a structure some parts of the world will remain at a permanent economic disadvantage. Opponents to such a regime argue that telecoms economics cannot be applied to the Internet, and that such a payments scheme would make the 'net prohibitively expensive and hinder the growth of e-commerce. Who is right? Hear both sides as a panel of experts review this issue and whether this issue has the potential to create a major international Internet crisis.

Participants:

TIMOTHY DENTON, Principal, T.M. Denton Consultants, *Canada*

KATHY FISHER, Senior Advisor-Asia, International Telecoms Policy, Industry Canada, *Canada*

ROBERT FRIEDEN, Professor of Telecommunications, Penn State University, *USA*

RICHARD THWAITES, Assistant Secretary, Australian National Office for the Information Economy; *Australia*

back

Workshops & Roundtables

Sunday 14 January 2001
1300–1600

Roundtables

RT3 Value Creation from Broadband: Application and Content Services

Location: South Pacific I

Discussion Leaders:

KEN ZITA, Executive Vice President Corporate Development & Co-Founder, Nupremis Inc., *USA*

STUART LACEY, Senior Vice President Corporate Development-Asia/Pacific, Nupremis Japan KK, *Japan*

JIM FISH, Senior Vice President, Product Strategy, Nupremis, Inc., *USA*

What does a carrier do *after* building a broadband access network? Where will new revenues come from? Service providers recognize that with the broadband revolution economic value is shifting from providing access services to delivering applications and managed content. Few carriers have the resources or strategic orientation to provide these "higher layer" services internally. At the same time, few customers look to their broadband local access provider as partners for business solutions. Telecoms providers are at risk of being marginalized in the New Economy value chain. How can carriers capitalize on emerging ASP services while building existing customer relationships and brand equity? What skills and infrastructure are required to provide scalable "carrier-class" solutions for delivering applications and content services? This roundtable discussion will explore how carriers can participate in the next frontier of the broadband services market: delivering business applications to the high-speed services environment.

back

Workshops & Roundtables

Sunday 14 January 2001
1400–1600

Roundtables

Special Interest Group
RT4 Federation of Regional Associations

Location: South Pacific III

Moderator:

HOYT ZIA, Executive Director, Pacific Telecommunications Council (PTC)

This open round table, a continuation of such meeting in past years, is designed to provide a sharing of information and concerns, among the heads of international and regional non-proft, membership-based organizational which focus on telecommunications and information technology.

Panelists:

DIANA SHARPE, Chairman, International Telecommunication Users Group (INTUG)

JANET PEARCE STENZEL, Executive Director, Telecommunication Program and Information Industry Forum, Pacific Economic Cooperation Council (PECC)

CLOVIS BAPTISTA, Executive Secretary, Inter-American Telecommunication Commission /Organization of American States (CITEL/OAS)

JOSE PILEGGI VELIZ, Chairman, The National Telecommunications Council of Ecuador (CONATEL) and charman of COM/CITEL

SAVENACA VOCEA, Manager, Pacific Islands Telecommunications Association (PITA), *Fiji*

back

Poster Sessions

Monday 15 January 2001

Location: Coral Lounge

1100–1500

Innovative Public Policy: Calling for an Innovation Standard for Telecommunications Universal Service

JAY EDWIN GILLETTE, Professor, Information & Communication Sciences, Center for Information & Communication Sciences, *USA* (Moved to M.1.1.4)

Benchmarking: An Annual Review of Your Telecom Rates

LEONARD ELFENBEIN, Chairman & CEO, and THOMAS BOOKWALTER, President, Lynx Technologies, Inc., *USA*

Tuesday 16 January 2001

Location: Coral Lounge

1100–1500

Digital Global Marketplace

THOMAS J. MCKEOWN JR., President and SAM VELARDE, Vice President, Vista Group International, *USA*

E Learning–Moving from Traditional Learning World to the E-Learning World

CAROLE ALCOCK, Lecturer and PENNEY MCFARLANE, Offshore Coordinator, University of Wollongong, *Australia*

Innovative Public Policy: Calling for an Innovation Standard for Telecommunications Universal Service

Jay Edwin Gillette

www.cics.bsu.edu

> It shall be the policy of the United States to encourage the provision of new technologies and services to the public.
>
> Sec. 7 (47 U.S.C. 157)
> [Communications Act of 1934, as amended] [1]

> Technology comes in successive waves. Those who have lost out on this wave can position for the next. Conversely, those who have made a killing on this cycle should not become complacent. The ability to profit under increasing returns is only as good as the ability to see what's coming in the next cycle and to position oneself for it-technologically, psychologically, and cooperatively.
>
> W. Brian Arthur [2]

1. Introduction and Summary: Realistic Universal Service through "Waves of Innovation"

One of the great regulatory dilemmas has been how to encourage telecommunications service providers to spread their best technologies and services across regions of their public markets toward a goal of "universal service" while not in practice making the minimum guideline become the maximum deployment.

This paper discusses a conceptual approach called "Waves of Innovation." The concept takes into account realistic deployment of new technology using a diffusion of innovation model. In real innovation, deployment comes in waves, and only gradually do individuals and communities move to new communication technology. That causes uneven development, and through increasing-returns economics, often results in "the rich getting richer, and the poor getting left behind."

The "Waves of Innovation" is a policy approach reflecting the spirit of Section 254 of the United States Telecommunications Act of 1996, which defines universal service as "an evolving level of telecommunications services."

2. Private and Public Policy that Rewards Leadership in Innovation

This policy breakthrough approach rewards vendors and communities for taking the lead in innovation, and especially through public and private partnerships.

The policy allows regulatory agencies to have a moving standard of innovation that constantly raises the bar for an entire region or state, so that the minimum guidelines or standards don't become the maximum deployment. It allows for partnerships and encourages the development of ongoing collaboration, especially between public entities. In the end, a "Waves of Innovation" approach can encourage and enable a to develop a culture of innovation.

3. Universal service: An Idea Whose Time Has Come, Gone, and Come Again

Universal service was designed in the 1930s to provide public policy that is succinctly stated: "The goal of universal service was to make basic telephone service available at an affordable price, anywhere in the nation." [3] By the 1980s, the goal was seen to have been accomplished, at least by the Bell System.[4]

Nevertheless, by the 1990s, after the breakup of the USA's Bell System in 1984, and with breakthrough technological and service advances, such as the personal computer and the Internet, pressure built to change the designation of universal service. Still, even in 1998 the FCC's definition of universal service still emphasized "basic services" (an approach from the early 1980s policy called "Computer Inquiry II"). [5] In practice this meant single-party telephone service; voice-grade access to the public telephone network; dial tone multifrequency or equivalent signaling; emergency services and operator access; access to directory services and long distance providers; and low-income subsidies. No "enhanced services" were included. [6]

As local regulators struggled to adapt the definitions to the needs of the time, specific regulations were enacted to try to keep up. The state of Kansas in the U.S.A. provided for reduced long distance rates to access Internet service providers in areas where local access was not available. The service had to support transmission speeds of 14.4 kilobits per second. This speed was seen as minimal, so the law required the speed to increase to 28.8 kilobits per second by 1999. Yet telecommunications companies were not certain they could guarantee such speeds, so they successfully lobbied for the law to change the rate to 19.2 kilobits per second in 1998.

These rates and these efforts point to the problem. Technologies change and advance, and capabilities change and advance. Once cast into law, these specific technologies and advances become the shape of the game: the lowest threshold guideline becomes the maximum provided the users or customers.

Yet the FCC did not specifically mandate the minimums described above. Let us review what the Federal Communication Commission characterizes as universal service:

> This rulemaking was initiated to define the services that will be supported by Federal universal service support mechanisms; define those support mechanisms; and otherwise recommend changes to FCC regulations to implement the universal service directives of the 1996 Act These directives are intended to promote the availability of quality services at just, reasonable, and affordable rates; increase access to advanced telecommunications services throughout the Nation; advance the availability of such services to all consumers, including those in low income, rural, insular, and high cost areas at rates that are reasonably comparable to those charged in urban areas. In addition, the 1996 Act states that: all providers of telecommunications services should contribute to Federal universal service in some equitable and nondiscriminatory manner; there should be specific, predictable, and sufficient Federal and State mechanisms to preserve and advance universal service; all schools, classrooms, health care providers, and libraries should, generally, have access to advanced telecommunications services; and finally, that the Federal-State Joint Board and the Commission should determine those other principles that, consistent with the 1996 Act, are necessary to protect the public interest. [7]

Section 254 of the Telecommunications Act of 1996 defines universal service as follows:

"IN GENERAL-Universal service is an evolving level of telecommunications services that the Commission shall establish periodically under this section, taking in to account advances in telecommunications and information technologies and services. . . . the definitions of the services that are supported . . . shall consider the extent to which such telecommunications services-

> "(A) are essential to education, public health, or public safety;
> "(B) have, through the operation of market choices by customers, been subscribed to by a substantial majority of residential customers;
> "(C) are being deployed in public telecommunications networks by telecommunications carriers; and
> "(D) are consistent with the public interest, convenience, and necessity." [8]

It is the challenge of regulators and community developers from local and national levels to find a way to enhance the spirit of this reasonable approach. Yet instead of defining universal service on a technological snapshot of time, we propose a different and more realistic approach: innovation as the standard for universal service.

4. Innovation theory: How to Understand and Foster Innovation

Technology and communications scholar H. Everett Rogers developed an important set of theories on the diffusion of innovations. In his seminal study on the topic [9], he analyzed adopters of innovations into five categories:

- Innovators (2.5% of adopters)
- Early Adopters (13.5% of adopters)
- Early Majority (34.0% of adopters)
- Late Majority (34.0% of adopters)
- Laggards (16.0% of adopters)

My understanding and experience is that these categories generally apply to organizations and communities as well. There are specific sets of values, characteristics, communication behaviors, and social relationships for the innovation adopters.

The issue for telecommunications public policy is to reward the communities and providers that move innovations forward in the region. The innovative communities need to be rewarded, and the following-on communities need to be encouraged. Convoys move at the speed of the slowest ship. That is designed to protect the slowest ship from attack. Yet public policy can not protect the slowest ship at the expense of the entire telecommunications convoy. That guarantees stagnation, and rewards laggards.

Instead, we need regulation that measures differences between the advanced communities and those most behind. Then we use the advanced community standard for a measure of where the next communities need to follow on. We reward the waves of innovation by assisting coalitions of communities and telecommunications providers in partnership, to bring the communities up to speed in new technologies and services.

5. Regulation and Policy that Rewards Leadership in Innovation

Regulation is often used to lock-in an obsolete technology and service strategic position by incumbent players and companies. See *Information Rules* by Shapiro and Varian, one of the most important books in the information economy [10]. How do we keep regulation from becoming a barrier against change?

New thinking is required. I recommend Tom Peters' breakthrough book *Thriving on Chaos: Handbook for a Management Revolution* called for and reflected a major change in management thinking in the United States. The "Handbook for a Management Revolution" isn't obsolete even though it's now more than a decade old. Many regions are just now beginning the management revolution he foresaw at the time the book came out.

International institutions, political, economic and cultural, need the kind of revolution in thinking Dr. Peters calls for and outlines. Regulators worldwide can use this book to help them understand, participate in and forward the kind of changes required by the information economy. [11]

Here is the international perspective: you can't change social structures without changing thinking. This necessarily will lead to disruptions. You can't have progress without leaving something behind. The key is not to leave behind the people that new technologies and services are designed to serve.

In answer to the telecommunications "haves/have nots" question: people will wait their turn if they think their turn will come. The regulation issue is how to make sure their turn will come.

6. How we innovate in Telecommunications: A Model for the Movement and Use of Information

When we speak of innovation in this field, there is often confusion but what we mean. Telecommunications-the sharing of information at a distance, is really focused on the movement and use of information. For clarity, I have developed a four-layer model of the field of information networking, which I define as "the movement and use of information."

When we speak of the field, whether we call it "telecommunications" or "Information Technology (IT)," the components are included in the four layers of the "Information Networking Model" illustrated in Table 1, Information content, information form, information transmission or networking, and information technology.

Table 1
Information Networking Model: "The Movement and Use of Information"

Content: *what* is contained in the information and its interaction with the other dimensions; information management and public policy of information included
Form: the applications of information; *how* the information is used by the end-client and how the other dimensions affect information form.
Transmission/Networking: the methods used to move information from source to node to network. **"Networking"** proper.
Technology: the physical basis in equipment and programming that allow the movement and use of information.

Innovation can take place in any of these four areas, or in combination of them. Proposals for innovation should be taken to the regional regulatory body, comparing the position of the advanced community in innovation, and the position of the community and telecommunications provider coalition that wishes to advance. Their proposals should be considered in a competitive framework, and the coalition whose innovation moves the community and region forward the best should be rewarded with funding.

The source of the funding will vary according to national and regional policy. In the United States, the source would be federal and state Universal Services funding.

Information itself is the key, not information services in themselves. The standard should be, does the change proposed lead to "waves of innovation" in the region?

7. The Practice of Information Networking: How we "Do Information" in the Information Economy

"Knowledge is information on the move." [12] How we "do" information-our practice of information networking-is how we are able to know what we know. This movement and use of information is what telecommunications means. Information networking is what every vendor in the information economy is in business to do. Information networking is what every user is looking for. Users together make up organizations and communities from a telecommunications perspective.

With the goal of bringing clarity to the process, I've analyzed the practice of information networking into five main parts. (See Table 2: "The Practice of Information Networking.") The main categories are information *access, filtering, storage, retrieval, using.*

In general, we move and use information through these five steps, most often in this order. From one person getting a document off her desk, to a multinational corporation sending an email message, the process is similar. Even while you read these words, you are essentially going through these five steps, in the movement of the words from the page through your short-term memory to your long-term memory and back to your active awareness you use to understand the sentences.

To take in the entire analysis in one glance, I've given the information in familiar written form. The same information content is in Table 2. Here are the five main categories, followed by the second level of analysis of the main categories:

- **Access** (Input, Processing, Movement, Output)
- **Filtering** (Display, Selection, Classification, Prioritization)
- **Storage** (Organization, Placement, Securing, Indexing)
- **Retrieval** (Searching, Finding, Bringing Forth, Queuing)
- **Using** (Applying, Presenting, Distributing, Deploying)

Reading this list, from top to bottom and left to right, shows the overall movement and use of information. I have given a number of traditional computing and information management terms to my categories, to show how traditional approaches fit into this overall analysis. Most of what we call "information management" can be located in these categories, and that is a useful feature of the analysis.

Certain categories could go in more than one place, for example, "securing." This is a second-level category in information storage. We secure information after we have stored it through organization and placement. For example, in the physical world, in a workshop, you put your tools in a drawer of the toolbox, then lock the toolbox.

Yet security can also apply at the information access category. We might encrypt a message as we input it, for security. In my analysis, that could become a deeper category, say at the third level of analysis, of "input." And so on.

The purpose of this analysis of "the practice of information networking" is to help us understand where our own information practices fit in. The table gives an overall view for clarity, for a common language in discussing what we're actually doing as we move and use information, and as a guide to planning information networking initiatives.

Table 2

The Practice of Information Networking				
Main Category of Information Networking	**Second-Level Analysis of Information Networking Categories**			
Access	Input	Processing	Movement	Output
Filtering	Display	Selection	Classification	Prioritization
Storage	Organization	Placement	Securing	Indexing
Retrieval	Searching	Finding	Bringing Forth	Queuing
Using	Applying	Presenting	Distributing	Deploying

8. Conclusions: Apply Advanced Complexity Theory to Telecommunications "Waves of Innovation"

California economist Brian Arthur adapts the paradoxes of complexity theory in practical advice to technology leaders, beginning with a striking metaphor he calls "the Casino of Technology." (In order to emphasize several of his sentences, I carefully have separated his quotation with blank lines, but have not altered the punctuation or paragraph structure. Thus blank lines in the following quotes do not show paragraph breaks in the original text.)

Brian Arthur says:

> [T]he Casino of Technology requires several things: excellent technology, the ability to hit the market at the right time, deep pockets, strategic pricing, and a willingness to sacrifice current profits for future advantage.
>
> All this is not just a matter of resources but also of courage, resolution, will. And part of that resolution, that courage, is also the decisiveness to leave the market when increasing returns are moving against one. [. . .]
>
> Technology comes in successive waves. Those who have lost out on this wave can position for the next. Conversely, those who have made a killing on this cycle should not become complacent.
>
> The ability to profit under increasing returns is only as good as the ability to see what's coming in the next cycle and to position oneself for it-technologically, psychologically, and cooperatively.
>
> In high tech, it is as if we are moving slowly on a ship, with new technologies looming, taking shape, through a fog of unknowingness. Success goes to those who have the vision to foresee, to imagine, what shapes these next games will take. [13]

Professor Arthur, whom I believe will someday be recognized with a Nobel Economics Prize, helps us to conclude that communities that have been left behind by telecommunications advances need not despair. With a "waves of innovation" public policy to encourage the diffusion of innovation, the lagging communities may catch a new wave telecommunications technology. They may "leapfrog" from the laggard position to the innovator or early adopter category. Communities can ride waves of innovation to new definitions of telecommunications universal service.

Notes

[1] James Shaw (1998). *Telecommunications Deregulation*. Boston: Artech House, p. 349.

[2] W. Brian Arthur. (1996.) Increasing returns and the new world of business. *Harvard Business Review* (July-August 1996): 108.

[3] R. F. Rey, Ed. (1983). *Engineering and Operations in the Bell System,* 2nd Ed. Murray Hill, NJ: AT&T Bell Laboratories, p. 692, n.6.

[4] Ibid., p. 698.

[5] Ibid., p. 702.

[6] Lynne Holt. (1998). June 1, 1998 briefing memo to KUSF Working Committee, "Background Information/Policy Issues Re: Universal Service Fund," p. 6. Topeka: Kansas Legislative Research Department.

[7] http://www.fcc.gov/ccb/universal_service [online] 9/18/00.

[8] James Shaw (1998). *Telecommunications Deregulation*. Boston: Artech House, p. 221.

[9] Everett M. Rogers (1983, 1962). *Diffusion of Innovations.* New York: Free Press.

[10] Carl Shapiro and Hal R. Varian (1999.) *Information Rules: A Strategic Guide to the Network Economy.* Boston: Harvard Business School Press.

[11] I know, for example, of a military officer involved in the significant challenges of defense institutions today who reads brief passages of the Peters handbook every morning to start his professional day.

[12] See Jay E. Gillette (2001.) "Information is Knowledge in Motion": A Practical Framework for Understanding Knowledge Management. In Richard Bellaver and John Lusa, eds. *Knowledge Management: The Practical Uses of Data Warehousing.* Boston and London: Artech House.

[13] W. Brian Arthur. (1996.) Increasing returns and the new world of business. *Harvard Business Review* (July-August 1996): 108.

Back to Poster Sessions

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Dr. Jay Gillette is Professor of Information and Communication Sciences at Ball State University's Center for Information and Communication Sciences in Muncie, Indiana.

Dr. Gillette teaches and conducts research in human communication; information networking design and development; telecommunications regulation, public policy and economics; leadership and management for the Information Renaissance; and information theory.

Previously, he was Professor and Associate Chair of the Department of Information Networking and Telecommunications at Fort Hays State University in Kansas. He helped set up the nation's first undergraduate degree in this new communication field, and also was a member of the industry team that helped develop Carnegie Mellon University's graduate degree in Information Networking.

Dr. Gillette served as a Senior Policy Fellow at the Docking Institute of Public Affairs in Kansas, and as a Senior Fellow of Information Technology and Telecommunications at the Center for the New West in Colorado, the policy research institute sponsored by U S WEST and other organizations.

He worked at Bellcore (Bell Communications Research) in New Jersey, now named Telcordia Technologies, as a Program Manager of the Information Networking Institute, as a Senior Technical Planner, and a Senior Project Manager in the company's Information Management Services division.

Earlier, Dr. Gillette was a professor of humanities and technical communication at the Colorado School of Mines. He also was an editor on the staff of the Mark Twain Papers at the Bancroft Library, University of California, Berkeley. He earned his Doctor of Philosophy and Master of Arts degrees in English at the University of California, Berkeley, and a Bachelor of Arts degree in Literature at the University of California, San Diego. In addition to his work in the information economy, Dr. Gillette has research interests in the impact of the industrial revolution in American culture, and in Mark Twain.

Back to Poster Sessions

Benchmarking: An Annual Review of your Telecommunications Rates

Leonard Elfenbein and Thomas Bookwalter

Abstract

Introduction

In today's highly competitive global telecommunications market, no company should go more than a year without benchmarking. Recent market conditions that considerably heighten the need for this exercise include:

- New entrants targeting narrow market niches and intensifying competition.
- Substitute products offering new, lower-cost alternatives, thereby increasing the pressure on market participants to lower their prices to remain competitive.
- The introduction of new technologies that decrease the cost to provide services.
- New applications like the Internet catapulting demand to new levels.

These and many other developments have destabilized prices. At the same time, intensified competition has made price points less visible. As buyers, we find ourselves flying at high speeds and low altitudes in a dense fog. Benchmarking is our radar system. Indices provide some help but not enough, since large-scale business telecom networks are unique for each company. Networks follow the business's geography. Services fulfill specific business needs. Benchmarking evaluates the specific requirements of a business and provides an assessment of the current market value of the networks required for those specific needs.

Benchmarking Methodology

The overall structure of benchmarking methodology is very straightforward. The following key points will be explored in more detail:

1. Define the requirement
2. Collect and organize the underlying data
3. Gather reference data
4. Align the information
5. Analyze the situation
6. Draw conclusions
7. Make recommendations

1. Define the Requirement

Whether performed internally or using the services of outside consultants, this first step significantly influences the cost-effectiveness and, ultimately, the success of a benchmarking project. Points to be addressed during this step include:

- What services will be benchmarked?
- Which service providers?
- Are we benchmarking existing services, new proposals or network designs?
- What is the geography - domestic, international, both?
- Are we focusing on local or long distance services?
- Is the pricing end-to-end or vendor point-to-point?

The answers to these and other questions define the entire project and establish the structure of the benchmark. For example, the benchmark structure for an international VPN network is different from that of a domestic Frame Relay network. A local services benchmark is extremely different than one for long distance or international studies. The requirements definition makes it clear what must be done and determines how best to proceed. It establishes what background data are needed from within the company. It defines the reference data requirements. It determines the time and resources required for the project. It also provides an early warning as to whether the project is practical or not. Perhaps most importantly, the requirements definition documents the agreement between the benchmarking team and management with regard to what is expected, what will be delivered and when it will be delivered. Changing the definition after this point changes the project and delays its completion.

2. Collect and Organize the Underlying Data

This is the perhaps the most difficult step in the benchmarking process, and the one for which most users are singularly unprepared. It requires that they collect and organize a large volume of information. It is a tedious, detailed process, and, if the network is large and complex or changes often, it is very probable that the information is outdated, decentralized and poorly structured. It is also likely that the user does not have the resources to independently gather and organize the data. In a globally disperse company, it is an especially slow process. Forms must be created, requests sent to remote sites, data templates developed and the information captured and organized. Many companies think they will save money be doing this "in-house." However, this only ends up delaying the project, and companies can ultimately lose millions on overpriced services while trying to save a few thousand. Required data include:

- Copies of contracts and all addenda
- Lists of services
- Annual commitments
- Detailed description of the networks, including site addresses, numbers and details of circuits and or services at each site
- Cost of each network element
- Hardware such as PABXs and routers
- Usage and billing details

For a new network design, estimates of usage and volume requirements replace historical data.

Our experience is that while this is a difficult undertaking, the task is well worth the trouble. For example, the discovery of discontinued services that are still being billed is a common occurrence in this step. Instances of ongoing charges for Centrex networks with 100+ lines that have been out of use for years or conference phone lines still being billed three years after the conference ended are not surprising. Recently, we found one company who could reduce telecommunications costs by more than $500,000 per year just by avoiding the late charges on its bills. Despite the obvious importance of gathering underlying data, most project delays occur during this step because users significantly underestimate the difficulty of getting it done.

3. Gather Reference Data

Up to this point, everything has been preparation. Benchmarking now begins in earnest. With customer-specific data in hand, we next gather and organize reference data from the market in general.

The first question to answer is how much of this information is available. The best market data sources are other real instances where vendors have provided the same or similar services to other customers. There is no perfect match because line speeds, locations of service, distances from vendor points of presence and other specifics will be different. And because prices are changing so rapidly, recent data are the most valuable.

It takes numerous contracts to assemble the data necessary to build a reference database. The more "hits" per location, the more durable the analysis. For some services and in some locations, the data simply do not exist. Hopefully, the expert benchmark team will have spotted where that might happen while defining the project requirements. Sometimes, the market data is the tariff, because in many of the developing markets, there is no competition and the local PTO remains a government agency setting the rates. In global networks, the distance between the vendor points-of-presence and the customer premises will play an important role in establishing the cost of service. Local access costs may be a significant part of the total cost.

External telecommunications benchmarking consultants add significant value in gathering reference data because they have access to many different contracts and proposals as a normal part of their business. They are able to more quickly assemble the reference information and to examine a wider information base for relevant data. These same benchmarking consultants often provide market study services to vendors. This gives them access to personnel within the carriers who may be willing to help understand a new service or find a price that is difficult to source. Consultants' familiarity with pricing keeps them up to date about prices in general. Their instincts will tell them if a price looks out of line. They are experienced at examining the data, and can tell if the data are real or the source reliable.

As a final example of the potential complexity of this step, there are many factors that define a price, and there are nearly 50 different data elements that define a rate. These include customer-related information, carrier and contract-related data, service definition elements, and rate specific elements. For rate specific elements alone, there are eleven different data points.

4. Align the Information

Once the benchmarking team has the company background information and the market reference data, the two databases must be aligned. The fit is never perfect, because those 50 defining data elements are different for each rate. The process of aligning the two databases is really the process of determining the common elements and establishing how to account for the differences.

The first step is to assess relevance and suitability. It may be that some of the data from a particular reference contract are relevant and suitable, while other data are not. Once the relevant data set has been defined, calculations are performed in order to establish the "effective rate." The effective rate is what the customer really should be paying. It is the base rate less discounts and credits. It reflects the total value of the contract, the amount spent for a specific service, the term of the contract, the currency of the rate and the currency of the payment.

The process also deals with the gaps. In some cases, they are simply ignored for any number of reasons. For example, the significance of some points in the network is minimal, or the cost of developing reference data is inappropriate. Other critical data points must be priced, and added research done. Sometimes the rate is estimated based on "surrounding" data, or calculated based on known ratios that are typical for the industry.

5. Analyze the Situation

Once a company's data have been gathered, the reference data collected from the market and the data sets aligned, the analysis can begin.

The first and most obvious analysis is of the prices and the implications of those prices. Are the differences nominal, or are they significant? In today's market, they are most often significant. Benchmarking is frequently used to evaluate an existing contract in order to determine whether the customer should enter into renegotiations with their carrier. If the contract is more than a year old, the answer is almost always yes. The difference between the current market and the original contract is usually 20% or more. Recently, we have seen differences of more than 70% in some two-year-old contracts.

The second part of the price comparison determines how much of the difference the customer can actually access. The benchmark will detect the "best prices" for given services, but the customers that have received those prices may have gotten them under special circumstances. The amount of energy required to get the vendor to change to the new lowest rates may be more than the customer may want to expend. The carrier may also be a major customer and other business realities may require that some savings be left on the table.

Determining the accessible savings results in establishing target rates for negotiations. Our experience is that without target rates, negotiations tend to be long and drawn out. It is strongly recommended that customers tell their vendors the target rates and let them respond. When this happens, negotiations tend to be shorter because the carrier knows that the customer knows the current market prices and, as a result, approaches, meets or even exceeds those prices much more quickly.

The third step is an evaluation of the cost to change carriers. In some cases, the market prices are so much lower than those offered in an existing contract that the current carrier is not prepared to meet them under any circumstances. The carriers rely on the cost to convert as a deterrent to change. In order to have an effective strategy, the benchmarking process should provide some insight into the cost to convert. That cost comes in two forms.

The first is hard costs. Installation charges, new equipment leases or purchases, internal manpower commitments and other vendor time to test internal equipment with the new telecommunications services are all part of the hard costs to convert.

The second is organizational impact. What is the business impact of a conversion? Will other projects be delayed or sidelined as resources are diverted to the conversion? What risks are involved if communications capabilities are temporarily lost during the conversion?

The last element of the analysis is the cost of delay. In a recent project, we identified more than $5,000,000 in excess costs on a leased line network. The cost of delay in getting new rates established was more than $400,000 per month. Allowing negotiations to drag on just three months would cost the customer more than $1,000,000. By identifying the cost of delay, customers are awakened to the urgency of aggressive action and can better justify diverting resources to solving the cost problems quickly.

6. Draw Conclusions

The conclusions are a summary of what the benchmarking analysis has revealed. They also provide the reference points for recommendations.

7. Make Recommendations

Recommendations are specific actions that should be taken based on the benchmark analysis. They range from renegotiating with the current service provider to issuing a new RFP for services. They include recommendations on contract terms and target prices. They provide the user with a plan of action for reducing telecommunications costs, and a long-term strategy for added savings in the future. They provide suggestions to give the user greater control of telecommunications spending, and they provide steps to take to keep vendors aggressive about providing quality service at the best possible price.

In Conclusion

Benchmarking is a scientific methodology comparing complex and difficult-to-understand custom tariff arrangements that have been negotiated between carriers and organizations exhibiting similarities in types of traffic and traffic flows. Benchmarking allows organizations to find out if their vendors are giving them the best possible pricing, or at least pricing that is competitive with what others are paying for similar services. It also provides irrefutable support in negotiations to lower telecom rates without the time and effort involved in preparing, issuing and analyzing responses to competitive RFPs.

Back to poster session

Leonard Elfenbein

Chairman and CEO
Lynx Technologies, Inc.

Mr. Elfenbein has more than 30 years of professional experience in telecommunications and computer technology, and is the principal founder of Lynx Technologies, Inc., a company he has headed for the past 23 years. He also served as President of Atlantic Bridge Corporation, an early international data services company, and Executive Vice President of software developer Wellington Computer Systems.

Back to poster session

Thomas Bookwalter

President
Lynx Technologies, Inc.

Mr. Bookwalter joined LYNX Technologies, Inc., as President in January 2000. For 15 years prior to joining LYNX, Mr. Bookwalter operated his own firm providing strategic consulting on financial, manufacturing, regulatory, service and network developments. The primary focus of Mr. Bookwalter's activities was in the international telecommunications marketplace. In 1993, as telecommunications market liberalization accelerated, Mr. Bookwalter began working with domestic and overseas PTOs, new carriers and international alliance to help them develop the skill levels, product offerings and processes necessary to succeed in the increasingly competitive global telecommunications industry.

Back to poster session

Benchmarking: An Annual Review of your Telecommunications Rates

Abstract

Benchmarking measures or analyzes telecommunications service rates by comparing them to rates for similar services being charged to other customers. In essence, it is a form of comparison-shopping. In our personal lives, most of us do the same thing when we buy a car, a TV, or a home. Yet many companies, when confronted with the magnitude and complexity of the task, shy away from benchmarking their telecommunications services.

Many telecommunications end-buyers believe that, in order to remain competitive, it is enough to follow a competitive bid process. Unfortunately, without good price discovery there is no way to tell if the best bid *is* a good price. For example, a LYNX customer was recently offered 50% reductions over old rates. Those seemingly great prices were still 30% higher than current "market rates."

As described in this paper, benchmarking is only one part of the total process of getting the best price for telecommunications services. The benchmark sets the milestone or the guidepost. The actual realization of savings comes during contract negotiations. A good benchmark not only defines the target, but it also helps define the best way to reach it.

Go to proceeding page **Back to poster session**

The Digital Global Marketplace

Thomas J. McKeown and Sam Velarde

Abstract

www.vistagroupintl.com

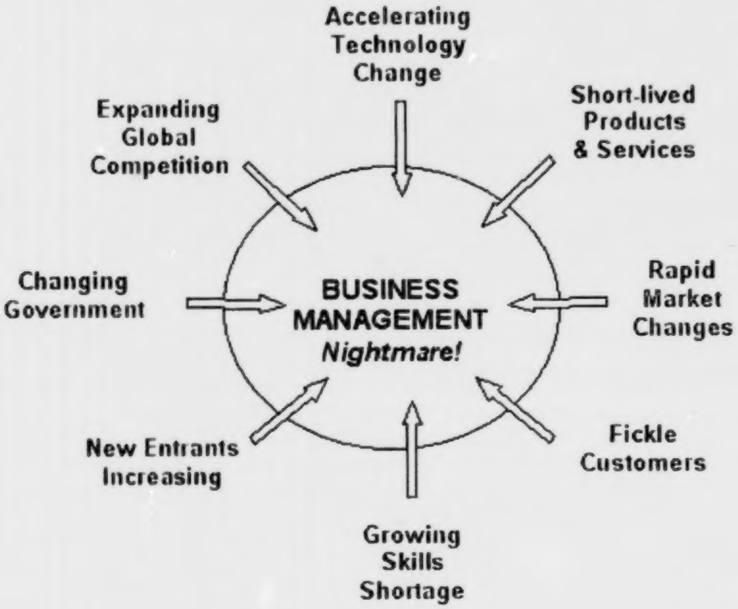
According to IDC, between now and 2004, Internet commerce and spending on the business and technical infrastructure to support Internet-based applications will grow almost tenfold - from $250 billion in the U.S. to two trillion dollars. The explosive growth of e-business made possible by the almost universal access to the Internet has elevated smaller entities to world-class competitors and is making it possible for them to enter expanded markets, distribution channels and offer new goods and services. Initially, Internet enabled e-commerce solutions permitted selling processes such as cataloging, order processing, payment and information exchange. This opened the door to the power of the e-commerce marketplace for the small to medium size enterprises (SME) by expanding geographic sales opportunities beyond local and regional constraints.

Today, implementing an e-business solution for real-time, up-to-the-minute information across the entire value chain, is necessary to gain and maintain competitive advantage. e-Business combines the sell and buy process with back office processes such as customer relationship, supply chain management, inventory management and enterprise resource planning including financial transaction processing. The result is a fundamental shift from inwardly optimized core internal processes to redirecting them outward toward business processes directed at customer and trading partner interactions. A new generation of process engineering has begun.

E-business by definition is the exchange of trading documents and information through electronic means, be it through enterprise LANs, the Internet, VPNs, PSTNs, or other data networks and service providers. By extension this also means e-business is a global phenomenon influenced not only by technology, but also by infrastructure developments, industry alliances and partnerships, market place developments, regulatory mandates, regional economic factors and finally entrepreneurship and innovation from the business communities. All these factors combine to form a dynamic environment requiring continuous strategic assessments in market trends, technology developments and assessments of competitors. With the increasing availability and use of e-commerce processes, merely selling over the Internet is no longer a differentiator to gain advantage and maintain an edge. Emerging growth centers where economic and technology transitions are occurring are among the ones to benefit most through adoption of effective Internet e-business strategies.

To plan, develop and implement a competitive e-commerce strategy, companies must gain knowledge to apply e-business technologies to business processes, analyze and evaluate what business processes must change or be adopted to bring about competitive advantage. A key role of Internet business strategy is to drive change within their organizations in order to adapt to new business models. A set of clear goals and expectations defined through a well structured planning process is an essential element to the over all strategy.

Gartner Group predicts that 7,500 to 10,000 marketplaces will emerge by 2002 and as many as 20,000 by 2004. Gartner Group also projects that the majority will ultimately not survive. This situation will create an environment that constantly pits the SME against the changing landscape of marketplaces. This environment of constant change will require companies to implement strategies for not only designing and integrating e-commerce processes, but also for adapting business processes as the digital marketplace landscape changes.


Accelerating Technology Change
Short-lived Products & Services
Expanding Global Competition
Changing Government
BUSINESS MANAGEMENT *Nightmare!*
Rapid Market Changes
New Entrants Increasing
Fickle Customers
Growing Skills Shortage

Integration will of course be a big problem in this environment. Marketplaces recognizing this problem will start to deploy integration technologies to be able to bring new trading partners quickly into their fold, many using different back-end systems. The task to enable companies to enter the market in the first place will still sit squarely on the SME. This poses a number of issues for the SME. First, the SME will be faced with planning and implementing an ebusiness strategy that factors digital marketplace choices, trading partners, and products and services that are consistent with the company's business goals. Second, continually updating or redesigning ebusiness processes and enterprise integration requirements. Third, deployment, operation and maintenance of an ebusiness system in an environment of continuous change. Gartner Group has issued several predictions that sum up this situation.

- Through 2002 80% of companies will implement incoherent strategies because of a failure to understand the characteristics of e-business, which will result in missed business opportunities
- By 2005, virtually integrated businesses will dominate 70% of all product and service industries
- By 2002, 70% of traditional enterprises that have sub-optimized their e-business initiatives by crating quick-fix Web sites aimed at minimizing disruption of current operations will fail to meet virtual e-business competitive threats and will lose significant market share
- Through 2003, 75% of businesses will under budget e-business transformation costs by 50% or more, especially when those costs are related to trading partners
- Through 2002, 45% of customer-relationship management initiatives will fail to deliver increased in effectiveness in customer interactions
- By 2005, companies will have completed customer-process reengineering in the following ways: About 20% will not have completed any reengineering at all, half will have completed only front-office reengineering, 20% will have also completed back-office processes, and 10% will have extended reengineering to partners and suppliers as well

Standardization and technology innovations will undoubtedly serve to improve e-business options and integration with enterprise back and front office processes. But, SMEs will still be forced to implement effective change management to keep up, remain current and maintain a competitive edge. A key point in addressing concerns from the SME is the task for building tailored integrated solutions on ebusiness platforms and building in knowledge management and collaborative capabilities for internal business processes. This has resulted in major shifts in e-businesses strategy drawing companies to the economics of Application Service Provisioners (ASPs). The ASP is a relatively new business model where program functions are sold as a service rather than as products. Applications are accessed remotely from the ASPs servers on a fee for service bases. International Data Corp. (IDC) defines ASPs as "service firms that provide a contractual service offering to deploy, host, manage, and enhance what is usually packaged applications software from a centrally managed facility." The cost of ownership, support and upgrade cycles are therefore taken over by the ASP. Companies are welcoming the ASP model overcoming initial caution and concern seeing the economic and competitive advantages of integrated e-business and Web hosting solutions they offer. Combined with the potential value of the services they provide and implemented with a highly directed integration strategy, risk reduction, complexity reduction and faster more reliable implementation of capabilities can result. Industry standard solutions have emerged over the last year indicating maturation in the ASP model and service offerings.

Some of the key enabling technologies that are reinforcing this business concept are:

- Ubiquity of the Internet and continuous development of Web-enabled solutions.
- Access and declining cost of bandwidth capacity, the combination of increasing accessibility and the continued declining cost of bandwidth
- Extensibility of shared applications in a client/server environment over the Internet or IP enabled networks. (ASPs will be key enablers in this role).
- Browsers as an accepted graphical user interface (GUI) application. The acceptability of browsers as a functional graphical user interface (GUI) has increased with the growing popularity of Web-enabled applications and tools and the proliferation of IP enabled network services.

In short the evolving e-business environment will witness a migration of the intelligence of virtual marketplace from the exchanges and market hubs to the desktop or at least to the enterprise network. Much of the intelligence or ability to connect buyers and sellers occurs at the exchange or marketplace hub where mapping, translation and routing take place. This model is increasingly being supplanted by end-to-end hosted e-commerce platforms that can connect or interact with a variety of marketplaces or bypassing the marketplace entirely. Marketplace hubs will not disappear any time soon but their importance to linking trading partners and processing transactions will become less needed as more of the end-to-end intelligence migrates to the user or enterprise. The role of integrators in close collaboration with ASP services will become more important and central to the overall customer and partnership relationships. This scenario will further enhance the basic ASP value proposition in that companies will not want to purchase and install hardware and software if they can access the functionality they need at a more reasonable and predictable cost.

In the context of SME needs and requirements, the ASP and integration market in general can be defined by three levels of supplier and buyer relationships: Those who buy and sell direct through an independent Internet channel or web site; those who buy and sell indirectly through a network of resellers and vendors; those who buy and sell through a marketplace. Each of these approaches will require different levels and scope of integration and application requirements.

Conclusion

Successful enterprises will undergo the transformation to e-business and the digital global marketplace. To successfully make that transition, the enterprise needs a strategically planned operating model embracing the unique competencies of that particular business. The model will serve as a risk management tool by which it can successfully plan and execute an e-business strategy. The model drives the convergence of business processes and technology architectures. Use of the Internet for e-business implementations transforms the way business is conducted. Relationships with customers, partners, suppliers and employees are all radically changed. Competitive advantage gained from e-business, therefore, is not focused around a single core competence, but a whole coordinated system of activities each reinforcing the other. The new paradigm of e-business is built not just on transactions but also on building, maintaining and improving relationships.

Back to Poster Sessions

Thomas J. McKeown, Jr.

Thomas J. McKeown has more than 20 years experience in corporate and government strategic planning and strategic management processes in support of the information technology (IT) industry. His strategic planning coordination and guidance has successfully helped generate corporate visions and strategic directions to select, develop and implement IT systems products and services, network architectures and information infrastructures. Mr. McKeown is currently Chief Operating Officer of GlobalNet Technologies Inc. and president of Vista Group International. He is a regular contributor of strategic planning papers to a variety of U.S. and international journals, including Federal Computer Week, Harvard Business Review, Pacific Telecommunications Review and other industry periodicals. A U.S. Navy Captain (Ret.), he is also a member of the board for the International Strategic Leadership Network (a premiere strategy organization). He is member of the Strategic Planning Committee of the Pacific Telecommunications Council and a member of the Sloan Institute for Strategic Planning, IEEE, AFCEA and ITPA.

Back to Poster Sessions

1102

Sam Velarde

Sam Velarde has nearly twenty-five years experience in government research and development, design engineering, program management and technology strategy in telecommunications and data networks for the Department of Defense, State Department and Central Intelligence Agency. In his career, Mr. Velarde has played the role of a program manager, designer and implementer of a variety of networks for voice and data and in the design of receivers and signal processing hardware used in wireless communications.

Mr. Velarde is currently Vice President Operations for GlobalNet Technologies Inc., an e-commerce and networks services company based in McLean, Virginia and Vice President with Vista Group International specializing in telecommunications strategic planning. Mr. Velarde is also President of Velarde and Associates, a telecommunications and technology strategy consulting company and a board member in the Strategic Leadership Network, a strategy organization

In his spare time Mr. Velarde builds log homes and over the last eight years has worked with a master craftsman building log homes. He is currently building a log home in West Virginia where he plans to retire when technology has succeeded in inventing everything there is to invent.

Back to Poster Sessions

The Digital Global Marketplace

Abstract

This paper addresses e-business strategy for small to mid-size businesses in emerging growth centers and developing nations and will discuss solution options and a planning model for implementing these solutions.

The explosive growth of e-commerce made possible by the almost universal access to the Internet has elevated smaller entities to world-class competitors and is making it possible for them to enter expanded markets, distribution channels and offer new goods and services. Internet enabled e-commerce solutions unlock the value of the e-commerce marketplace for the small to medium size enterprises (SME) by expanding geographic sales opportunities beyond local and regional constraints. Emerging growth centers in developed countries and in developing countries where economic transitions are occurring are among the ones to benefit most through adoption of effective Internet e-commerce strategies.

Assessing out-sourcing options to dedicated Internet working centers for equipment, operations hosting, transaction processing, training and customer relations (i.e., help desk, order tracking, queries etc.) are essential if an e-commerce implementation is to be successful. Questions regarding Service Level Agreements, Quality of Service criteria, pricing, reliability, redundancy, location and disaster recovery are additional factors to be considered when assessing out sourcing options.

Use of the Internet for e-commerce implementations transforms the way business is conducted. Relationships with customers, partners, suppliers and employees are all radically changed. Competitive advantage gained from e-commerce, therefore, is not focused around a single core competence, but a whole coordinated system of activities each reinforcing the other.

Go to proceeding page   Back to Poster Sessions

E - Learning Moving from the traditional learning world to the e-learning world.

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Whenever a course of study is being prepared from kindergarten to university post graduate level, the ultimate goal could justifiably be argued that the knowledge gained prepares the student for the 'real world'. The process of obtaining that knowledge focused on the communication of that information, whether in a written or oral tradition. Students and the teacher acquired a common vocabulary, a common language in order to best communicate that information. The teacher would observe and interact with students in the classroom or lecture theatre in order to reinforce and support any concepts which were seen to be unclear. Overall participation of the student in this particular environment was that as the receiver, participating in a passive manner, with little to no interaction. Interaction would take place in the tutorial session held in a different venue at a different time, potentially with a different person. Feedback would be given to the tutors, not the academic, causing a barrier in determining what is actually being understood.

This traditional process was put into place to facilitate the transfer of knowledge from the academic to the student. Numbers of students in any lecture situation were determined and limited to ensure the effective transmission of that information. Unfortunately, economic and other pressures on educational institutions today have altered that condition. It is not uncommon to have hundreds of students in a lecture where previously there would be tens of students. Various broadcasting technologies would be utilised to transmit the lecture, which has been designed for a traditional delivery process, to those students in the audience. The academic is faced with the situation of successfully imparting knowledge to their student body.

Planning the e-learning site is essential and should be initiated well in advance to ensure the success of the course. As with any subject, the activities undertaken must meet the subject outcomes. This requires planning, and for the academic involved, more planning than the 'traditional' subject would require. This additional work would involve the design of the site as well as ensuring the aims and objectives are established. Certain strategies must be followed to ensure success of the course.

The strategies that need to be covered would have to be suitable to a web-based environment where the academic may never meet the students. Implementing those strategies would need to be thought through first, envisioning the end and developing the particular activities required to achieve that end. Evaluation is even more critical in this environment than in the traditional classroom as there is no 'body language' or questions from the floor that the academic can respond to. This requires a well thought through evaluation strategy, which would involve contact or feedback methods. By ensuring a multi-faceted feedback system the academic and student would be comfortable that information is being disseminated properly as well as set project timeframes being met. One final area of concern is that the flexibility of the website could be a challenge to the lecturer in charge. The ease at which the interface can be modified, information can be disseminated, additional material can be added, makes it all too easy for the designer to lose track of the original design, or worse still, be forever spending time on refining and modifying and not getting the work done.

Ensuring that the acquiring of knowledge and skills that would be utilised in the 'real world' is of paramount concern for the educator as well. Frequently the skills acquired are far more importance than the knowledge being gained. Among those skills would be the ability to effectively search for information from a variety of sources. Another skill identified would be that of ascertaining which information source is valid as opposed to others. Working effectively in groups, sharing information, assigning tasks is another area identified. This achieving of skills while gaining knowledge can be seen in the use of purpose designed web classroom technologies, one example of which is WebCT.

These web classroom technologies provide a secure website which allows a level of design by the academic to best suit his/her needs in the learning environment. It is a contained 'world' gained by password access only. That world is a model based on the aims and objectives established in the construction of the subject by the academic. The student enters this specially designed world and explores the avenues constructed for the subject under study. Not only are many avenues for academic exploration presented but also students are encouraged to discover new 'pathways'. Through the use of lecture topics, tutorials and online questions students utilise the Internet and other sources to gain the knowledge required to successfully complete the subject. Indeed, web classroom technologies like WebCT encourage student learning through 'taking possession of and mastering information.' (Cicognani, 2000)

Online learning has identifiable stages where the acquiring of information can be seen. These stages are listed below.

1. The ***generalisation*** stage: in this phase the learner is introduced to the background information related to the subject he is about to learn, and is confronted for the first time with the instruments that he will use in the learning experience.

2. The ***focussing*** stage; here the learner has already grabbed the principles of the subject studied deriving

them from the background of the generalisation phase, and is now focussed on the development of a specific understanding of topics and skills involved in that subject.

3. The ***application*** stage; in which the learner comes across problem solving activities and applies the principles acquired in the previous two stages.

4. The ***consolidation*** stage; after the majority of information has been passed onto the learner there is a clear need of consolidating that information so that it is absorbed in a longer timeframe. (Cicognani, 2000)

Structure of a typical flexible learning site

Lecture Support. It is in this area where the lecture content is placed. This can be done in a variety of formats, the most common being an html document. Other commonly used formats are pdf and powerpoint slides.

Links. It is not uncommoon for a subject to be shared between two or even three academics. To facilitate contact, without the learning curve required of the WebCT, this section allows for a direct link to those academics' web site. Here they post their lecture notes and any other relevant information. In an ideal world, it would be a better structure to have all the lectures put in the same section on the WebCT, but that should evolve over time. Another use for the links section is a categorised source of useful Internet and library database links as determined by the academic. This can be added to easily.

Forum. This is one area of great potential. Here, students can post questions and comments or refer others to useful web sites or other sources of information. It is not a chat room, but a bulletin board area. Communication with the academic can take place here, and regular monitoring of this area of the class web site is essential to encourage proper use. If students discover a useful site for the course, it can easily be added to the links section, thus developing a rich source of continuing information for the subject.

Calendar. Only the academic in charge can add dates to this particular section, but students can access this to doublecheck assessment and exam dates. It can, however, be downloaded to the student's computer and become their virtual classroom organiser for their personal study skills.

Surveys. This is a trial area where a database of survey questions can be compiled by the academic and opened to the students for subject feedback. A variety of questions types are available over a range of topics such as content, delivery and assignment feedback. A statistic return of survey results is generated by the package in use, providing useful feedback for future course construction.

Uniqueness of the e-learning environment

Staff members who enjoy the face to face communication with students, the e-learning environment poses many obstacles. Without the verbal and nonverbal feedback, those academics find the elearning environment frustrating. This can be overcome by sharing common interests in the forum, opening discussions on relevant topics for the subject and generally creating an online community. Further measures for establishing an e-learning community are:

1. Practice writing rich statements to the students in the Internet delivered course.

2. Ask the students for feedback several times while the course is in session to keep that contact, now in virtual form, alive and well.

3. Send virtual greeting cards or virtual bouquets of balloons to let the students know that they are important to the instructor. (Fuller, et al 2000)

Various types of e-learning environments allow for the student to study at all hours of the day and night as well as at their own pace. WebCT allows for calendars to be put into its structure, thus allowing for definite due dates and goal setting. This encourages the academic to be planned ahead of time as well, which should allow for a well structured course.

Managing time is an issue regardless of the course delivery method. With the WebcT environment, students are encouraged to ask questions in the forum area. Responses are encouraged from fellow classmates, yet there is a great demand on the academic to monitor what is being said and keep in touch with the student's concerns. Properly managing this time is essential to ensure that no further pressure is brought to bear on the teacher. One solution would be to post forum monitoring times as if they were consultation or class hours. This benefits the academic and the students, and again lends structure to this flexible environment.

Strengths

The strengths of online learning are many. The size of IT classes that face the academic, having a 'venue' where students can go to check lecture notes and confer with other students is a 'godsend'. Students are able to review information at their leisure. Questions can be asked of the group and answered by those who are interested, or reviewed by the academic responsible for maintain the site. Revision questions can be posted and answers can be obtained in a variety of methods, from straight up to online guided tutorials. Useful links can be incorporated as part of the site or as part of the revision activity allowing students the flexibility to explore those areas that either interest them, or concern them for the lack of knowledge. Updates of necessary information can be made available to all from one source. Use of this web site also familiarises the student with the technology involved and makes them more able to cope with today's e-world. Indeed, the most successful environments are: 'those which allow maximum flexibility, for example by supporting multiple protocols and formats, at the same time providing a solid and stable structure that learners can recognise over the course of their learning event.' (Cicognani, 2000)

Weaknesses

The weaknesses of online learning are many and varied. Perhaps the greatest weakness is that it is online. Contact between the academic and the student is limited. This lack of face to face contact is of great concern, due to issues of interpretation, clarity of understanding, and language differences. The alternative of actually contacting the lecturer is severely limited. It should be noted that use of the online learning area does offer an opportunity for the student to attain the required information and certainly doesn't prohibit physical contact with his/her lecturer. The benefit of the online learning is restricted to the student's ability to use the online site. Accessing the Internet, maintaining contact, being able to afford access fees, all impact on the student's chance of success in the subject. Students who are not comfortable with the technology would be hampered by their steep learning curve into this 'brave new world'.

By its very nature, access to the online learning area is only as successful as the connection to the Internet, the robust nature of the server and the multi-platform basis of the software being used. Failure on any of those levels renders the site useless and a waste of time.

One very important factor that must be mentioned is the academic's attitude towards using technology and in particular using the Internet as a platform to mount the subject for students to use. In other words, 'advances in IT tend to outpace academic staff attitudes towards, and knowledge about, the way in which technologies may enhance teaching and learning.' (Fox, 1999) A significant issue is also the time that is required for the academic to learn the technology, adapt the course of study for mounting in the new learning environment and maintain the site once established. This is supported by the findings of Kiesler, Siegel and McGuire (Oct.1984). They found that "problems in making the change to computer mediated communication came from pressures of time, an absence of regulating feedback, the absence of nonverbal behaviour weakening social influence, the absence of status and position cue, social anonymity leading to depersonalisation and lack of established norms and etiquette leading to a breakdown of established boundaries." (Fuller.2000)

At a practical level, the traditional teaching method relied greatly on the use of printed material. The e-learning environment is more than just the printed text. This does not negate the use of digital text. A concern must be raised that if digital text is put onto a webCt site, thus replacing the huge printing requirements of many subjects, that no printing will take place. What does happen is that the cost of the printing is passed on to the student who learning mode requires the sequential basis of text, or needs the media on paper for revision purposes. A potential solution is to recommend online journals for students to explore on their own for articles on the relevant topics.

Opportunity

The e-learning world is a global world. Universities are branching out into other countries where previously they wouldn't have ventured. Establishing a webCT enables the offshore partner to have the same opportunity to access the information as the onshore institution. Students can logon to the relevant site, use the same links, obtain the same information should that is required. On a more exciting note, the establishing of an e-learning environment can be catered for each learning institution's own needs. Concepts that need clarification can be dealt with in detail establishing unique learning tutorials complete with Internet links, vocabularies and discussion questions. The potential contact for one lecturer, one university, one subject is limited only by the desire to expand.

Threats

Consideration must be made of the 'thin edge of the wedge' concept. Once a web classroom site using the suitable technology has been established, how can the academic's intellectual property be protected? What guarantee is there that other institutions won't copy the concepts, instructions, tasks from the initial site and use it as their own? What guarantee is there that once the site is established, the academic is redundant - no longer required as the tutorials cover student questions?

Essentially there is no guarantee. In reality there is no guarantee of that condition now. What has been established at UOW is a password and entry eligibility system for students who are enrolled in the subject to have access only. Even should the password be guessed, the student cannot enter unless he/she is a registered student with admissions at UOW.

Staff need support when integrating web classroom technologies like WebCT into the curriculum. This should involve an ongoing program rather than a once off training session. Hopefully, this should ensure that new technological innovations are taken up as well and the continued support for staff who were the initiators of the e-learning environment.

Another area of support staff will need is in the area of student challenge. By encouraging students to search and explore information on their own, they could easily pose contradictory yet researched points of view to that of the lecturer. This could be quite daunting for the academic who could previously dispute information in a text that rapidly becomes dated as opposed to information discovered days before. Faculties/schools will need to support their members as they face this confrontational issue.

The Future

In order for successful implementation of web classroom technologies like WebCT to occur, there needs to be an opportunity for the university involved, the academic, the faculty or school, students and other interested parties to 'take a step back' and confer. What is occurring now, is a duplication of delivery techniques which is adding to the burden of the academic, rather than relieving the delivery pressure. What should be sought is a balance between which subjects suit online delivery, which academics should use it, and the most effective means of delivery for the students. The faculty or school should then assist the academic by offering support for the first subjects to go into the e-learning world. Once established, an effective model will be able to follow by other teachers and enable an easier transition into the e-learning environment.

FLEXIBLE TEACHING

The adoption of these new web classroom technologies and electronic resources requires a flexible approach to teaching and learning. Indeed, exploration of these new methods is essential if we are to continue to promote a high standard of excellence in the learning environment we provide for our students.

Approach to learning

If students are to benefit from the subjects they are studying, it is important that they have an interest in the end results of the tasks they are required to perform. This interest should be more than whether they achieve a pass or fail grade. The aim should be to achieve a balance, first, by encouraging students to complete their assignments satisfactorily, which will enable them to pass their subjects, while, second, allowing them to gain some tangible benefit in the form of developing a specific interest or skill. This approach is particularly useful when attempting to incorporate the various tertiary literacies within the curriculum. It is also of benefit to students attempting to develop knowledge specific to their future careers.

Subject examples

The subjects for which web classroom technologies (both WebCT and 'in house') have been used cover many areas related to the use of online information technology and resources. The following is a list of specific subjects which will give some idea of the scope:

IT and Citizens' Rights
Information and Communication Security Issues
World Wide Networking
Information Management
The Information Market
Online Information Services

Linking the theoretical with the practical

While there is a strong theoretical component in each of these subjects, it is essential to link the theoretical with the practical by incorporating the use of technology both in teaching and, where appropriate, within the assessment tasks. In World Wide Networking, students use web technology (demonstrtion of site can be provided) and were introduced to videoconferencing. In Online Information Services, students used both traditional and web based online services to complete targeted research. They also undertook projects developing web sites to meet specific information needs of an organisation. Students were encouraged to undertake real projects where possible, and many did so. In 1998, some students were involved with the University of Wollongong's own home page developments. Students' attitudes to this particular assessment task were positive, some even indicating that they had received further work as a consequence of the experience gained.

Flexibility

As the focus of teaching is on the use of new technology, it is important to adopt a flexible approach to delivery of information by making best (and appropriate) use of the technology available. To this end, subjects are presented using a mix of media, as indicated above. Of particular interest is the development of ways to integrate a variety of media. Work with the University's educational development unit on this aspect, was particularly successful when teaching Online Information Services from the University's Sydney Centre in 1997. While this subject was taught only in Sydney that year, a group of international students wished to have the option of taking the subject in Wollongong. As the University has excellent videoconferencing facilities on campus, and facilities were available at the centre in Sydney, it was agreed that students would have the opportunity of taking this subject in Wollongong. A further commitment to flexible delivery was demonstrated in the development of World Wide Networking, particularly with the changes put in place during. No lectures are required in this subject, but students are required to make appropriate use of web resources in both access to information, interactive discussion with class members and presentation of their assignments.

Internet / Web Resources

Subject material for all subjects is made available on the subject web site and interactive use of the Web is encouraged. Links with database resources, discussion groups, Lab tasks, lecture notes and assignment requirements have been provided in this way. While web based facilities have been used for some years now, WebCT has recently been adopted for the delivery of subjects in parallel with the existing sites. That is, this year, both the standard web site as well as the WebCT version have been provided, to be sure that there are no problems with student access. Currently negotiations are taking place with the Library to explore ways to provide soft copies of articles to students off campus, both locally and off shore. This will further extend the students' access to subject material online.

Videoconferencing

Videoconferencing as it is set up at the University is a powerful technology. In the delivery of the subject: Online Information Services discussed above, it was possible to incorporate the same range of media as is available in our best lecture theatres: PowerPoint slides, video-clips, a document camera to show overheads or other materials, network access to demonstrate database resources or show web sites. All of these options were used to advantage in course delivery, and students made good use of the technology in presenting their seminars.

One real advantage of videoconferencing with this particular group of students was the way in which their participation in class discussion improved. Students are sometimes reluctant to participate in class discussion. This is very much the case for some of our international students, and understandably so. The nature of videoconferencing was discussed at the outset, and emphasis placed on the participatory nature of the medium. The result was beyond expectations, particularly in seminar discussions. Examples of this can be seen on some of the video-clips which have been preserved from these sessions, and in the *Flexible Delivery* video produced by the University (this may be shown if desired).

Integrating teaching media

The web page which was set up for this subject (Online Information Services), complemented the interactive elements of the videoconferencing technology described above. This gave students access to the course outline which included details of subject objectives, assignments, lists of readings and other relevant details. As well, copies of subject notes, PowerPoint slides and details of Computer Lab tasks were made available here. A discussion list was established within the web site, and seminar papers were posted here by students prior to their presentations. In addition to electronic resources, some supporting material was supplied in the form of a book of recommended readings. However, students were encouraged to make good use of the research skills they were developing through the tasks they were required to complete in the computer labs.

This subject (Online Information Services) demonstrates the way in which a flexible approach to delivery can provide a challenging environment for students. The integration of a variety of approaches incorporating both theoretical and practical elements and providing opportunities for both individual and group activities presents an environment which promotes positive "learning" outcomes. While it is not possible, nor appropriate, for all subjects to be taught in this way, most of the elements indicated above do fit well with the IT field. Indeed, in all of the subjects discussed above, a flexible approach is taken to the provision of materials, and in the manner of assessment. In this way, subject objectives are achieved in the most effective manner.

Conclusion

> "The university as a physical space will remain attractive to the extent that we will make it more valuable for people to interact personally and face to face in learning and research...." Gerhard Casper, President of Stanford University. (DeLong, 1997)

Clearly, the e-learning world is one of great potential. This paper has emphasised how important it is to provide a positive learning environment. To do this, it is essential to be responsive to change and to welcome new opportunities by making the best possible use of whatever resources are available. This does not always mean that old technologies should be discarded in favour of the new. Print technologies are vital and highly valued elements in the education system. However, it does mean being willing to experiment, listening to feedback, and providing a number of options in the ways in which subjects are presented. The new e-learning environment is here to stay. We must make the most of it.

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Back to Poster Sessions

Penelope McFarlane

My career in teaching spans more than twenty-five years of high school teaching in America and Australia. Subjects I have taught have ranged from English, to Social Science, to History to being the librarian for several years. It was during this time that my interest in technology developed and I achieved my Masters in Information Technology and Communication from the University of Wollongong in 1993. Since that time, I have worked as a casual tutor/ delivering subjects at the first and fourth year level. I have been employed as the School of Information Technology and Computer Science Offshore Coordinator in a full time for the past two years. This work has involved coordinating subjects at the first year level capacity as well as delivering subjects at the fourth year and Masters level. I have a Level 4 TAFE certificate in networking.

As Offshore Coordinator my work involves contact with many educational institutions overseas countries as well as delivering subjects in a flexible manner. Subjects I deliver offshore include: Telecommunication Network Planning, Information and Communication Security Issues and The World Wide Networking. It is my work in these areas which has fostered my keen interest in flexible e-learning subjects and delivery methods.

Areas of research are in ecommerce development in Southeast Asia, flexible delivery subjects focusing particularly on cultural differences in various countries as well as online journals.

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Addendum

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Sunday, 14 January 2001

WKS2 Change in Panelist Title

MICHAEL REEDE, Partner, PWRW&G, *Hong Kong SAR China*

WKS3 Additional Panelists

PETER LORD, Associate, Morgan Stanley Dean Witter, *USA*
FRED COHAGAN, Manager, Broadband Services, *USA*
JEFF STARK, Executive Vice President Sales & Marketing, The GTX, *USA*

RT1 Change in Participant

EDWARD MCCORMACK, Chief Operating Officer, Flag Telecom Ltd., *United Kingdom*

RT1 Canceled Participant

YASUHIKO NIIRO

RT4 Additional Panelist

Savenaca Vocea, Manager, Pacific Islands Telecommunications Association (PITA), *Fiji*

Monday, 15 January 2001

Opening Plenary Addition of presentation title

Dr. Jung Uck Seo, Minister of Science and Technology, *People's Republic of Korea*
Toward the Global Information Society — Opportunities and Challenges

M.1.1.4 Added Speaker

JAY EDWIN GILLETTE, Professor, Information & Communication Sciences, Center for Information &Communication Sciences, *USA*
Techniques for Financing Telecoms and Internet Infrastructure Buildout in Asia

M.1.2 Added Chair

ROBERT HARBISON, Principal/Analyst, VentureView Associates, *USA*

M.1.3 Change in Room Location

Latin America
Location: Honolulu Suite

M.1.3. Added Chair

JAGADISH RAO, Consultant, USA

M.1.5 Added Chair

GREGG DAFFNER, Chief Strategic Officer, Q-east Broadband, *USA*

M.1.6.3 Correction of Speaker Name

WONGSUK KANG, Assistant Professor, Nanyang Technological University, *Singapore*
Internet Commerce Models in Asia: Case Study on Singapore and South Korea

M.2.1 Correction in Room Location

Reducing Global Telecommunications Problems
Location: Tapa III

M.2.2 Added Chair

JAMES HEBERLE, VP Sales and Marketing, Monterey Telecommunications Technology, *USA*

M.2.3.2 Cancelled Speaker

GUANGYU WANG, VP, Beijing CapitalNet, *People's Republic of China*
Competition of Wireless Players in China Telecom Market Deregulation

Replaced with
Michelle Chan, Captial Network s Co. Ltd., *People's Republic of China*

M.2.3.3 Change in Paper Title

GUXIING HUANG, CEO, and QILIN XIE, VP, Guangdong South Satellite Telecommunication Service Co., *People's Republic of China*
Current Status and Development of Satellite Communication in China

Tuesday, 16 January 2001

T.1.1 Added Chair

CHRISTINA HIGA, Associate Director, PEACESAT, *USA*

T.1.3 Added Chair

ROGER NAFF, Vice President, Boeing Satellite Systems, *US*

T.1.3.2 Added Speaker

EUI K. KOH, Vice President for Asia Pacific, New Skies Satellites N.V., *Singapore*
First Pan-Asia Broadband Multimedia Satellite for B2B and B2C Services

T.1.3.3 Added Speaker

LARRY G. VALENCIANO, Group Director Asia & Pacific, INTELSAT, *USA*
Asian Market Access: The Gateway to Opportunities (BOIP)

T.1.4.1 Change in Paper Title

LAWRENCE HENDERSON, Vice President & Director, Solutions Engineering, Telecom Carrier Solutions Group, Motorola, *USA*
3G- Next Generation Networks Applications and End-user Devices

T.1.5. Postponed to 11:00

Digital TV Regulation
South Pacific I/II

T.2.1 Cancelled Speaker

MANUEL RAMIREZ, Director, Special Events, Televisa, *Mexico*

T.2.1 Cancelled Speaker

ELIAS RODRIGUEZ. Director, Technical Operations, Televisa, *Mexico*

Replaced with
ROBERTO PINEDA, Chief, New Technology Projects, Televisa, *Mexico*

T.2.2 Session Update

Communications In The Pacific Rim, Five Years Into The Future

This Webcast Super Session provides a forum for three distinguished leaders in Communications to provide a personal, industrial, and regional perspective on what wireless services in the Pacific Rim will be like in five years time. Societal and individual perspectives will be discussed. The challenges of 'getting there' will be defined, as will various scenarios for addressing those challenges. Ample time will be provided for audience 'grilling' of the panel. Bring your own thoughts, visions, and questions and learn about the future!!

SEON JONG CHUNG, President, ETRI, *Republic of Korea*

Roles of Mobile Services in Global Internet

Cancelled Speaker
LARRY SCHWARTZ, Vice President, Telecommunications Industry Applications Business Unit, Compaq Computer Corporation, *USA*

Replaced with
MITESH DESAI, Vice President, Marketing & Business Development, Compaq Telecom, *USA*

Added Speaker
TAO YUN, General Manager, China, Q-east, *People's Republic of China*

Cancelled Speaker
SETHAPORN CUSRIPITUCK, Director General, Post and Telegraph Department, *Thailand*

Cancelled Speaker
ROSS LAU, President International, Qwest Communications, *Hong Kong SAR CHINA*

T.2.3 Cancelled Session - South Pacific Islands

T.3.1 Session Title Change

Go Into the Cultural Online Technology

T.3.1 Added Chair

BRUCE DRAKE, Executive Director Pacific, Industry Canada, *Canada*

T.3.1.3 Added Speaker – Moved from T.3.2.1 – Application Implications

NOBUYOSHI TERASHIMA, Dean, Graduate School of Global Information and Telecommunications Studies, Waseda University, *Japan*; LALITA RAJASINGHAM and JOHN TIFFIN, Victoria University of Wellington, *New Zealand*; and ANNE GOOLEY, Queensland Open Learning Network, *Australia*
An Experiment of Cultural Heritage Presentation System

T.3.1.3 Cancelled Speaker

MICHAEL JANIGAN, Executive Director and General Counsel, Public Interest Advocacy Centre, *Canada*
Coming to Terms with the Digital Divide

T.3.2.1 Moved to T.3.1.3

NOBUYOSHI TERASHIMA, Dean, Graduate School of Global Information and Telecommunications Studies, Waseda University, *Japan*;
LALITA RAJASINGHAM and JOHN TIFFIN, Victoria University of Wellington, *New Zealand*;
and ANNE GOOLEY, Queensland Open Learning Network, *Australia*
An Experiment of Cultural Heritage Presentation System

T.3.2.2 Moved to T.3.3.1

NASWIL IDRIS, Chairman of Educational Laboratory, The Indonesian Open Learning University, *Indonesia*
Prospective Situations (Innovative Ways) to Fully Utilize the Limited Multimedia (Internet) Access for Distance Learning / Open University In Indonesian Education

T.3.3. Addition of Chair

JAGADISH RAO, Consultant, *USA*

T.3.3.1 Added Speaker – Moved from T.3.2.2 – Application Implications

NASWIL IDRIS, Chairman of Educational Laboratory, The Indonesian Open Learning University, *Indonesia*
Prospective Situations (Innovative Ways) to Fully Utilize the Limited Multimedia (Internet) Access for Distance Learning / Open University In Indonesian Education

T.3.5 Change in Author's Title and Paper Title Addition

GORDON BRUCE, Director, Administration and Information Services, The Estate of James Campbell, *USA*
How the Economy is Changing Due to Networked Enterprises and How Corporate Enterprises and Changing Due to the Networks

T.3.6.4 Presenter

RICHARD ROMAGNIN0, Director Submarine Network Solutions, Nortel Networks, *Canada*

Wednesday, 17 January 2001

W.1.4.1 Added Speaker

SCOTT CHASE, Publisher and Executive Editor, The Strategis Group, *USA*
Next Generation Wireless: Emerging Market Opportunties

W.1.4.2 Presenter

CHEOR-BEOM PARK, IMT-2000 Development, SK Telecom, *Republic of Korea*
Efficiency Improvement of Channel Element Utilization Through a New Radio Access Network (RAN) Architecture of IMT-2000 System

W.1.5 Additional Panelists

A. ADIWOSO, Aces Satellite
D. D'AMBROSIO, Vice President, Stratos Mobile
A. AUCKENTHALER, General Counsel, Inmarsat
S. SCHNEIDER, Former General Counsel, BT Mobility
J. ROSE, Satellite Consultant
W. COUTLER, Former General Counsel

W.1.6 Paper Title Addition

Tim Denton, Principal, T.M. Denton Consultants, *Canada*
Fear and Loathing in the Peering Process

W.1.6 Added Speaker

BERNADETTE JEW, Partner, Gilbert & Tobin, *Australia*

W.2.1 Added Chair

TERRY CHARMAN, Managing Director, TCI & Associates, *Australia*

W.2.2 Change in Country

TERRY HILSBERG, Chief Executive Office, NextEd Ltd., *Hong Kong SAR China*

W.2.3 Addition of Chair

GEORGE LISSANDRELLO, President & COO, Infoserve International, Inc, *USA*

W.2.4.1 moved to W.2.6.1

GIHYOUK LEE & WONHEE SULL, Platform R & D Center, SK Telecom, *Republic of Korea*
Carriers Network Infrastructure in the New Millennium

W.2.4.3 Change in Speaker's Title

WILLIAM R. ERICKSON, Senior Vice President, Planning, Fujitsu Network Communications, *Japan*

PTC2001 Closing Plenary

Wednesday, 17 January 2001

THE VIEW AHEAD
THE ROLE OF GOVERNMENT, INDUSTRY AND USERS IN THE INTERNET'S FUTURE

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WINSTON. THOMPSON, Chief Executive Officer, Telecom Fiji Limited, *Fiji*

PTC Mid Year Preview
NAM JIN CHO, PTC Korea Chapter, *People's Republic of Korea*

Carrier Perspective
TADASHI NISHIMOTO Vice Chairman, KDDI, *Japan*
The Role of a Network Operator in the Future of Internet and Mobile Communication

Government Perspective
KOICHI UCHIDA, Director-General of International Affairs Department Telecommunications Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT)

Major Users' Perspective
HONORABLE WARWICK SMITH, Executive Director, Macquarie Bank, *Australia*

Individual User Perspective
GREGG DAFFNER, Chief Strategic Officer, q-east broadband, *USA*

Exhibits

Correction of Exhibit Booth Number

Xdrive Technologies Booth #105-106

Cancellation of Exhibit Booths

The Global TeleExchange Booth #18

iLocus.com Booth #47

Mockingbird Networks Booth #68

Additional Exhibits

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SK Telecom has diversified its business scope to IMT-2000 service, multimedia online service based on the Internet, GMPCS, International Call and Handset manufacturing by its subsidiaries and others. For more information on SK Telecom, come to the World Wide Web at www.sktelecom.com

Space Systems/Loral (SS/L) is a premier designer, manufacturer, and integrator of powerful geostationary (GEO) satellites and satellite systems. SS/L also provides a range of related services, including mission control operations and procurement of launch services. Based in Palo Alto, California. SS/L has an international list of commercial and governmental customers whose applications include broadband digital communications, wireless telephony, direct-to-home broadcast, environmental monitoring, and air traffic control. SS/L is ISO 9001 certified. For more information, visit www.ssloral.com

Sprint is a global communications company,Ñat the forefront of integrating long-distance, local and wireless communications services, and is one of the largest carriers of Internet traffic. Sprint built and operates the United States' first nationwide all-digital, fiber-optic network and is a leader in advanced data communications services. With annual revenues of more than $20 billion and total assets of $39 billion, Sprint has more than 70,000 employees worldwide. Founded in 1899, the company maintains its world headquarters in Kansas City. Sprint's local office in Honolulu, Hawaii (host city of PTC2001) offers Sprint's full suite of voice and data services to Hawaii corporations and businesses.

Subic Telecommunications Company, Inc. (Subic Telecom), a Joint Venture formed by PLDT, AT&T and SBMA in November 1994, is a "full service" telephone company designed to provide the telecommunications requirements of the Subic Bay Freeport Zone.

Teleglobe is a leading provider of broadband services, with an extensive global communication network. Delivering advanced broadband applications to customers worldwide -- by matching global reach with unsurpassed service -- Teleglobe is setting the standard for digital convergence.

The Leading Telco of Thailand.

verizon

Verizon Communications (www.verizon.com), formed by the merger of Bell Atlantic and GTE, is one of the world's leading providers of communications services. Verizon companies are the largest providers of wireline and wireless communications in the United States, with more than 100 million access line equivalents and 25.6 million wireless customers. A Fortune 10 company with more than 260,000 employees and approximately $60 billion in 1999 revenues, Verizon's global presence extends to 40 countries in the Americas, Europe, Asia and the Pacific."

WHEREVER.net

WHEREVER.net is a leading provider of telephony solutions utilizing Internet Protocol (IP), with an extensive global VoIP network of over 100 Points-of Presence (POPs) in countries around the world. WHEREVER.net's current IP telecommunications products and services include direct dialing IDD, Virtual Private Networks (VPNs), phone cards and other value added communication services. More information on WHEREVER.net can be found at www.wherever.net.

WORLDCOM

WorldCom (NASDAQ: WCOM) is a global leader in "all-distance" communications services with operations in more than 65 countries. Revenues in 1999 were $37 billion, with more than $12 billion from high-growth data, internet and international services. For more information visit www.wcom.com.

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Satellite Broadband offers cutting edge satellite solutions to the emerging communications technology challenges brought on by the broadband explosion. Connect to www.thebroadbandspace.com

COMMUNICATIONSWEEK

INTERNATIONAL

CommunicationsWeek International is the global newspaper for business, strategist and managers in communications carriers and multinationals.

Global Telephony

Global Telephony guides network operators - both new and incumbent, wireline and wireless - in their quest to compete in the worldÕs new market. www.globaltelephony.com

The Forum for the convergence of technologies & minds

The INFOCOMMS Forum
In recognition of the convergence of information and communications technologies, the INFOCOMMS Forum series was launched at World Telecom '99 in Geneva, beginning with INFOCOMMS Forum Asia Pacific, which widens the coverage of issues beyond telecoms development and liberalisation to include the role that the Internet and wireless technologies play. Other regions that will be covered shortly include Africa, North America, Europe and Middle East. Please contact info@infocomms.com for more information.

Intele-CardNews

Intele-CardNews is a monthly magazine that reports on practical Applications and business solutions provided by prepaid telecom products. This includes prepaid calling cards, prepaid wireless, prepaid dialtone, smart cards and the use of voice over Internet protocol. For your free subscription visit www.intelecard.com.

International Engineering Consortium The International Engineering Consortium (IEC) is a nonprofit organization dedicated to catalyzing positive change in the information industry and its university communities. The IEC provides high-quality educational opportunities for industry professionals, academics, and students. The industry is represented through substantial corporate support and the involvement of many thousands of executives, managers, and professionals - www.iec.org.

PHONE+ International

Phone+ International provides carriers, resellers, agents and aggregators in Europe, Asia, Latin American, the Pacific Rim and other regions with information and analysis that helps them advance their operations and grow international traffic volumes through alternate channels.

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tele.com, asian edition is the only regional publication to deliver comprehensive regional coverage of the business and technology issues facing Next-Generation Service Providers. It is the definitive source for both news and in-depth analysis on all of the next-generation network technologies. Every month, regulatory, technological & economic issues affecting the telecommunications industry in the region are reported and assessed.

TOTAL TELECOM

Total Telecom the daily news resource for the telecommunications and networking professionals - see www.totaltele.com.

Via Satellite

Via Satellite, the industryÕs leading magazine, keeps its more than 22,000 subscribers Òin the knowÓ by providing essential news and analysis on the commercial communications satellite industry, including current and evolving applications, infrastructure issues, technology (broadband, satellite and multimedia), and business and regulatory developments around the world. For more information, visit www.viasatellite.com and www.satellitetoday.com.

3U

Underground, Underwater, Under-Ice

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3U Technologies / Innovatum

Booth #23

3U Technologies represents Innovatum, Inc. to provide technologies for locating and tracking submarine and terrestrial cables, including the ability to encode a unique permanent magnetic signature onto the cable. Cable magnetization benefits the cable owner during installation, operations, and maintenance activities–providing long term cost savings and improved system security. 3U Technologies specializes in international business consulting, project management, and engineering services to the submarine cable and offshore industries and to the terrestrial cable community. 3U has extensive experience worldwide including the North America, South America, Europe, the Far East, the Pacific Rim, and the Middle East. 3U provides a broad range of engineering, project management, maintenance, and magnetization services providing unique, cost effective solutions to difficult technical and management challenges. Contact 3U for your difficult Underground, Underwater, and Under-ice requirements

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Asia Access Telecom

Booth #52

AAT is an emerging international telecommunications company structured to take advantage of opportunities in the dynamic international telecommunications market. Worldwide deregulation is presenting emerging carriers with vast growth potential as countries open up their markets to competition. AAT's plan is to focus on the rapidly growing Asian marketplace.

AAT provides both origination and termination services between the U.S. and points in Asia through its switching facility located in Los Angeles, California. In conjunction with its in-country partners, AAT offers its customers dedicated access to the most competitive international rates available. AAT continually evaluates the rates and quality of both traditional and emerging carriers and integrates these results with its own direct agreements. This process permits AAT to be more nimble and competitive than other carriers. AAT's competitive advantage is in being able to continually offer its customers access to the best values.

AAT, its partners and affiliates are poised to leverage its products; market position and experience in the Asian market to better serve its customers.

ACT Teleconferencing

Booth #29

ACT provides a full portfolio of teleconferencing services that meet our clients' needs for faster, more effective communications (internally and externally) Interactive virtual meetings using the latest technologies

Flawless event conference calls and presentations to audiences of 4 to 4000 people The results? We make our customers more productive and more competitive.

Building on our 11 year history of high quality service in the audio, video and data conferencing arena, ACT continues to release innovative services based on the latest technologies–including ClarionCall VoIP based conferencing, web driven conferencing, and interactive internet conferencing. By providing a full range of traditional and new services, ACT has the complete solution for our customers collaborative communications needs. ACT's global service network enables our customers to use our conferencing solutions wherever they may travel or have offices with worldwide service and local language support.

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Advantech, Advanced Microwave Technologies

Booth #2

Advantech, Advanced Microwave Technologies Inc. (Advantech) is a Montreal (Canada) based, world-class designer and manufacturer of leading-edge Microwave Communication products for Satellite Ground Earth Station applications (S-Band to Ka-Band) and for Wireless Base Stations (1.9 GHz to 38 GHz frequency range including PCS, MMDS, 3.5 GHz and LMDS).

The main products designed and manufactured by the company are Solid State Power Amplifiers (SSPA) with output power ranging from 1 Watt to 3,200 Watts in power, Mast Head Units for Cell Extenders/Repeaters, Up/Down Converters, Boosters and other related sub-systems. Our company's products, which follow CE and ISO-9001 standards, are compact and operate under very harsh environmental conditions.

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AEROVIRONMENT

Booth #67

AeroVironment Inc. is a privately-held company with a minority investment by General Motors. Founded in 1971 by Dr. Paul MacCready, AeroVironment quickly became known for breakthrough technological achievements, including the first effective human-powered and manned solar-powered airplanes. AeroVironment has over twenty years of experience with solar-electric airplanes, and is recognized as the world leader in solar-powered flight. The company is skilled in the development, fabrication, and operation of a variety of unmanned aircraft systems, and, with funding support from NASA, is developing a stratospheric platform that is ideal for telecommunications applications.

AeroVironment's SkyTower stratospheric platform is a flexible, low cost, high capacity telecommunications system based on AeroVironment's unmanned solar-electric aircraft technology. Because SkyTower systems overcome the last-mile local access barriers facing conventional telecommunications approaches, they are excellent complements/alternatives to terrestrial and satellite systems for applications including fixed and mobile broadband as well as direct broadcast services.

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The Aerospace Corporation

Booth #14

The Aerospace Corporation is an independent, nonprofit corporation whose principal mission is applying the full potential of science and technology to the advancement of space systems. Aerospace provides support in all fields and disciplines of research, development, engineering, acquisition, operations, and program management for space and space-related programs. Aerospace operates a federally funded research and development center (FFRDC) for the U.S. Department of Defense, while also providing research, engineering support, and consulting services for other public and private agencies, organizations, consortia, and commercial companies involved in space technology and its applications.

Some areas of expertise include launch vehicles, propulsion, satellite design and orbital systems, remote sensing, ground systems, telecommunications, and signal processing. Examples of engineering support and direct consulting services include reliability analysis, risk analysis and lifecycle cost modeling, systems engineering, test and evaluation, launch and on-orbit failure analysis, and independent readiness reviews.

As an independent and unbiased resource, Aerospace adheres to the highest standards of objectivity and nonadvocacy, providing services of only the highest technical caliber.

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Arbinet-thexchange

Booth #93

Arbinet-thexchange is the full-service, online exchange for on-demand transactions, automated physical delivery and settlement of trades of telephony bandwidth. Thexchange is neutral, favoring neither buyers nor sellers, and allows participants to trade anonymously. Automated delivery is accomplished by employing advanced trading software and a set of patented processes to link the web-based trading platform with carrier-grade telecommunications switching equipment. Arbinet-thexchange handles all settlement, collection and payment for trades effected on its exchange and provides continuous monitoring and online rating of the service quality of each seller's network.

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Arianespace Inc.

Booth #94–95

Arianespace is the commercial launch services leader, holding more than 50% of the world market for satellites placed in geostationary transfer orbit (GTO). Formed as the first commercial space transportation company in 1980, Arianespace has signed contracts for more than 200 satellite payloads.

The key to Arianespace's success is the Company's unbending focus on meeting customer requirements by continually adapting to changes in the international launch market. Arianespace offers its customers unrivaled launch services, with worldwide support from corporate headquarters in Evry (near Paris), the launch site in Kourou, French Guiana, a subsidiary in Washington, DC and offices in Tokyo and Singapore.

ACE

www.ace-asia.com

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ASIA CAPACITY EXCHANGE

Booth #19–20

Asia Capacity Exchange is a worldwide, neutral telecom exchange through which telecom carriers, ISPs and enterprise customers can buy, sell and physically deliver network capacity on demand. ACE's web-based trading system enables wholesale telecom capacity traders to anonymously enter Buy and Sell orders for capacity–ranging from clear channel, frame relay and IP bandwidth to international circuit-switched voice minutes and voice-over-IP.

Operating as a neutral clearinghouse, ACE offers buyers and sellers cost-saving tools and services to increase trading efficiency and optimize inventory management. Automated traffic delivery is accomplished through the ACE's Telehubs using the company's proprietary trading software, which dynamically matches Bandwidth and Minutes contracts between buyers and sellers. ACE provides a turnkey solution including provisioning, network monitoring, online reports, service level agreements, clearing and settlement. In addition to its trading operations, the ACE Website has emerged as the industry's leading telecommunications community–offering news and regulatory information to thousands of industry participants and analysts.

BAND-X
Changing the Way Communications Are Bought & Sold

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Band-X

Booth #41

The first online exchange with four active trading floors and over 12,000 members worldwide. Membership to Band-X is free and any member can post a bid or offer at no cost. Fees are paid only if a transaction is completed through a Band-X facilitated introduction. At the heart of Band-X's success stands its core values–it is independent, it never trades its own capacity or facilities, it treats buyers and sellers equally. It also has the financial backing to ensure its long-term success.

The trading floors for International Communication services are:

- Networks

x.com

- Co-location
- Switched Minutes
- Routed IP

Today, Band-X provides their exchange services worldwide with local offices and/or personnel in France, Hong Kong, India, Ireland, South Africa, South America, The Netherlands, The United Kingdom and the United States.

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BizTone.com

Booth #121

BizTone.com has a reputation for successful application development. Since it's founding in September, 1996, it has launched several packaged enterprise applications that are in use worldwide. It has completed work for international corporations including Hitachi, Motorola, and Binariang. It currently maintains a staff of 90, Headquartered in Singapore with offices in Kuala Lumpur, Malaysia; Denver, USA; and Melbourne, Australia. BizTone was the first software company to be granted MSC (Multimedia Super Corridor) status in Malaysia, and the only company appointed as an Authorized Java Center in Malaysia. It works closely with both Sun and IBM in promoting and developing Java applications throughout Asia and the USA, and continues to build its products around core technologies that have proven themselves for more than 30 years. Today, the company is backed by the resources of Nomura/JAFCO Investments, Asia Java Fund, ING Barings and Sandstone Ventures.

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Boeing

Booth #26–27 / #35–36

The Boeing Company, Space and Communications Group, has a full fleet of launch vehicles to address the space transportation needs of the satellite industry for the 21st Century.

Payload fairings range 3 to 5 meters in diameter. Payload launch weights to GTO range from 0.9 to 13.1 metric tons. During its 40-year history, Boeing has launched almost 400 payloads for 17 countries.

Sea Launch and the family of Delta launch vehicles–Delta II, Delta III and Delta IV–are ready to serve customers in all payload classes. We provide launches to low-Earth orbit (LEO), medium earth orbit (MEO) and geosynchronous orbits as well as earth escape missions. Affordability, flexibility and reliability are the hallmarks that make Boeing a world-class launch services provider.

Boeing is committed to being the world leader in providing low-cost access to space.

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Cable & Wireless

Booth #55–56

Cable & Wireless have built a new business, Cable & Wireless Global, which will incorporate our 100% owned businesses in the US, UK, Europe and Japan. We are now able to run the company as one seamless global organisation. This structure is unique in the industry and gives us real competitive advantage.

Cable &Wireless Global is building the only single global high capacity IP infrastructure, as a solid foundation for our future growth. It's a £2b plus investment and we are also spending £300m this year to put in place a suite of products globally to address the high growth IP market.

To execute our strategy and build our presence in the US, UK, Europe and Japan, we are investing £7b on acquisitions and capital expenditure. As part of that strategy we announced that we had bought 11 ISPs and 4 Network Integrators which gives us an immediate footprint in Europe. This makes us the 3rd largest business provider of IP services in Europe.

Partner Services is the division within Cable & Wireless, which supplies global expertise to Carriers and Service Providers. The business unit serves approximately 1250 customers ranging from multinational communications organisations and increasingly ISPs and ASPs.

Carlson Wireless Technologies, Inc.

Booth #111

The Price/Performance Leader in Fixed Wireless Technology. Carlson Wireless Technologies, Inc. (CWT) is a technology company based in northern California. CWT optimizes the latest breakthroughs in digital wireless technology to create exceptional price/performance in wideband fixed-wireless systems that interconnect home and industry with the public switched telephone network. The i-WLL Trailblazer extends two full-service POTS telephone lines up to 22 km line of sight with an integrated antenna, or up to 80 km with an external parabolic grid antenna. Both lines deliver crystal-clear voice and up to 56 kbps dial-up modem speeds. The Trailblazer uses the 2.4 GHz license-free ISM frequency band and is being successfully deployed by leading telecommunications carriers and industrial corporations around the world. In the second half of 2001, CWT will introduce a point-to-multipoint 5.8 GHz i-WLL system delivering full-featured telephone service to multiple-user clusters in rural areas at an unprecedented price per user.

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China Quantum Communications

Booth #28

China Quantum Communications Ltd. (CQCL) is a next generation communication enabler. It provides the most comprehensive IP content deliver services for carriers and services providers between China and the rest of world using its most efficient content deliver network, Quantum One. Quantum One is a business-class IP network that has its Gateway Centers and Gateway Nodes in many major cities in throughout Asia, Europe, and North America. In China, Quantum One peers with ten regional business-class IP networks and reaches 90% of total communication density in China.

CQCL delivers voice, data, audio, and video contents in IP format with efficiency, security, and reliability. It offers VoIP, International VPN, audio/video streaming, and e-commerce solutions for the international carriers, services providers, and content providers.

CLARENT.

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Clarent Corporation

Booth #66

Clarent Corporation (Nasdaq:CLRN) is a global market leader in providing intelligent, software-driven products throughout IP-centric communications networks, serving more than 300 telecom service providers worldwide such as AT&T, NTT and China Telecom. Clarent solutions enable interconnection between communications service providers' networks and foster the creation of global footprints. In addition, Clarent's software platform allows carriers to develop limitless new features for consumers and enterprises. Founded in 1996, Clarent is headquartered in Redwood City, Calif. and has offices in Asia, Europe, Latin America and North America. To learn more about Clarent, visit its web site at www.clarent.com.

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Clarity International

Booth #B

Clarity International Limited is a provider of Quality Of Service and Provisioning Solutions. We offer the telecommunications industry a proven integrated product suite that covers the complete OSS and Customer Care arena.

The Clarity team has in excess of 15 years industry experience and knowledge working together and has formed strategic partnerships to enable that knowledge to continue to grow from strength to strength.

Clarity has established local offices throughout Asia Pacific, Europe and The Americas. Our International Headquarters based in Sydney, Australia, was established at the inception of the company in 1993.

Clarity International makes the commitment to all customers to provide a proven product suite with a defined product roadmap for future growth, implemented by a strong, experienced and dedicated project team.

The Clarity team look forward to meeting you at the Pacific Telecommunications Council at booth C, alternatively please feel free to e-mail us at marketing@clarity-int.com.

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Colo.com

Booth #69

COLO.COMSM builds and maintains Neutral Optical HubsSM for the deployment of distributed networks and content-rich, interactive applications and services close to end-users. COLO.COM's Neutral Optical Hub colocation solution enables long distance carriers, competitive local exchange carriers, Internet Service Providers and other Internet-based businesses to gain rapid access to advanced network and facility resources. COLO.COM allows its customers to focus staff and capital on bringing new products and services to market rather than colocation and associated services.

ColoConnection

Booth #118

ColoConnection.com is a carrier neutral "telcograde" colocation provider. Coloconection is the first provider to offer services in a majority of properties that are "owned" facilities by our affiliate company, Telecom Routing Exchange Developers, Inc. ("T-Rex"), aTerremark Worldwide Company. Owned facilities will allow the company to respond to power, riser and extended term requirements more efficiently than our competitors in addition to the traditional colocation advantages of capital preservation, outsourcing of operations and access to multiple network providers. ColoConnection is rolling out a North America footprint,but is also expanding internationally to "owned" facilities in Latin America and Asia.

The Company provides flexible pricing plans, multi-site discounts and customer-defined space. Our secure, highly-powered facilities are accessible 24/7/365. Hands and Eyes services are available in all locations.

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Comtech EF Data Corporation

Booth #124

Comtech EF Data, a major supplier of digital & RF products for Government & Commercial applications, offers a complete portfolio of high quality satellite communications products and systems for "one source" convenience.

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Cordell, Inc.

Booth #76

Cordell is a global communication company, providing Hut-to-NOC solutions, that increases service provider performance parameters for network quality, reliability, and service. Cordell Hut-to-NOC core capabilities include intelligent mediation, network health and data management, service assurance, and a migration to TMN network management. With more than 10,000 systems installed worldwide, Cordell is the leader in Intelligent Mediation, Network Health Management and Network Data Collection.

cygent

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Cygent

Booth #87

As the leading provider of comprehensive eBusiness Support Systems (eBSS), Cygent is the first software company to create a communications-specific solution from the customer perspective, enabling any interaction, for any service, through any point of contact. Cygent-powered solutions streamline the customer-retailer-wholesaler demand chain for communications services, increasing revenues by enabling the one-stop shop for transport, content, and applications while reducing operations costs. Cygent works with complementary technology partners, leading systems integrators, and recognized industry organizations to provide best-of-breed, standards-based solutions for all of a service provider's customer interaction needs. Cygent's customers cross all tiers and service types and include Genuity, Telecom Italia, Vectris Communications, and XO Communications. Cygent is a privately held company, with headquarters in San Francisco and regional offices in Asia, EMEA, Canada and the U.S.

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Securing e-business

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Cylink

Booth #48

Cylink Corporation designs and manufacturers a comprehensive family of secure e-business solutions including wide area network (WAN) encryptors, public key infrastructure (PKI), virtual private network (VPN) appliances, smart cards and smart card readers, and toolkits. Founded in 1983, Cylink is the first company created to market security solutions for protecting communications sessions with public key cryptography. Cylink serves Fortune 500 companies, multinational financial institutions, and government agencies worldwide. Cylink WAN Encryptor family secures voice, video or data transmitted over high-speed ATM or frame relay networks, leased lines, and ISDN to protect against eavesdropping, data interception or malicious attack. Cylink's encryptors can be remotely configured and monitored from a single location or distributed across several management stations by Cylink's PrivaCy Manager, lowering the costs associated with managing multiple security devices on enterprise networks.

Cyras Systems

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Cyras Systems

Booth #88

Cyras Systems' bold new optical switching technologies help carriers revitalize their networks. The Cyras K2 optimizes voice services, tames the rising torrents of data traffic and paves the way for innovative new communications services. Taking advantage of the Cyras switching architecture, carriers can now extract the full potential from their existing networks while integrating advanced provisioning & transport functions into rapidly changing, demanding and complex mixed-traffic environments.

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ECI Telecom Inc.

Booth #34

ECI Telecom provides digital telecommunications and data transmission Systems to service providers in over 140 countries worldwide. ECI Telecom will showcase Next Generation Telephony and Transport Networks solutions.

The Next Generation Telephony solutions are comprised of IP mediagateways, soft-switch call agents, signaling gateways and a comprehensive Operational Support system.
Transport Networks include the T::DAX family of Digital Cross-Connect Systems (DCS). The T::DAX supports narrowband, wideband and broadband capabilities on a single economical platform.

ECI Telecom is built on a solid foundation of customer commitment and technological excellence. Service Providers can make their networks more competitive; offering cost effective expanded capacity, enhanced performance and new revenue generating services by deploying Next Generation Telephony Solutions and Transport Network Systems.

ElephantTalk
1901-07 Tower 3
Guterprise Square
9 Sheung Yuet Road

ElephantTalk

Booth #135

Established in 1994 and as licence holder of US FCC214, HK ETS and ISP PNETS, ElephantTalk provides a wide range of voice telecom services including IDD, pre-paid calling card, callback services and refile services to multi-national corporations, local and international 1st tier carriers. In 1999, ElephantTalk has diversified to provide IP VPN, IPLC, broadband Internet access, facilities management, Web Hosting, Server Co-location through its wholly owned subsidiary ET Network Services

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Website: www.etns.net

Limited (ETNS).

Other than the above-mentioned licences, ETNS has acquired the External FTNS licence and our partner in China holds a nation-wide ISP Licence with ISP Special Access Code granted and the nation-wide Call Centre Licence.

ETNS has invested and been operating an over 30,000km optical fiber backbone network in China. To capitalize on this important asset, ETNS has built Internet eXchange Centres (IXCs) in major cities in China, Taiwan and Singapore and has entered into partnership with various Satellite companies for providing of satellite-based IPLC to customers.

Epoch Internet

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Epoch Internet

Booth #31

Epoch Internet is a new generation of Internet Service Provider. As the United States largest privately held ISP, were dedicated to supporting the demand for high-performance access and hosting solutions in the International markets.

Epoch Internet's high-speed US network delivers dedicated backbone access in over 40 metropolitan areas, 10 international (fiber and satellite) exchange points, and remote access from over 820 locations. Its world-class data centers provide secure, reliable hosting or co-location for Web site or e-business solutions. And its state-of-the-art systems and industry-leading provisioning and customer support capabilities are second to none.

Epoch provides the fundamental building blocks for e-business, including:

- A full range of access solutions (up to Full STM1) including turn key transit offerings over satellite and fiber networks.
- Choose dedicated or shared Web site hosting, or secure server co-location–our world-class data centers offer the level of service our customers need.
- Including firewalls and Virtual Private Networks (VPNs).

Epoch Internet's customers receive world-class customer care, including around-the-clock support from highly trained engineers and technicians, and Service Level agreements that give them the highest guaranteed levels of service.

Fortec

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Fortec & Associates

Booth #8–9

Fortec, Inc., the world's largest producer of rotationally molded polyethylene phone booths designed for high visibility, branding, long life, & low maintenance.

Protel Payphones: America's largest iso 9001 manufacturer of smart payphones, management systems, & fraud prevention equipment.

The Courtney Company: America's largest designer and integrator of dc power systems for the telecommunications industry including power boards, batteries, generators, & alarm monitoring systems.

france telecom

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France Telecom

Booth #50—51

France Telecom Long Distance's complete range of OpenTransit® wholesale solutions include end-to-end transit, direct interconnections, Internet connectivity and value-added services. These are based on its European Backbone Network, extensive worldwide IP mesh and 160 direct switched routes, incorporating more than 60 direct ISDN links. With the integration of Global One, the scope and quality of service has been enhanced, boosting worldwide reach and local expertise.

With operations in 75 countries and 27.2 billion euros in 1999 revenues (first half 2000: 15.3 billion euros), France Telecom is one of the world's leading telecom carriers. It provides businesses, carriers and consumers with a full range of services, including local, long-distance and international telephony, with data, wireless, Internet, cable-TV and value-added services. With the acquisition of the UK mobile operator Orange, France Telecom is the second largest European mobile operator and serves more than 17.5 million wireless subscribers worldwide. France Telecom is listed on the Paris Bourse and the New York Stock Exchange (NYSE: FTE).

Visit France Telecom on stand 50 & 51 at www.carriers.francetelecom.fr

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GENERAL TELECOM
Booth #107-108

General Telecom is the original and leading independent provider of tier-one partition switching, network management and control services in the United States. With itÕs interconnected.Nortel DMS 250-300 switch facilities in New York, Los Angeles and Miami, General Telecom provides confidential and secure interconnections between national and international carriers, network operators, resellers, arbitrageurs and others wishing to gain fast, economical access to domestic and international telecommunications service markets.

Global Telephony Magazine

Global Telephony Magazine, an Intertec/Primedia publication guides telecom leaders from Asia to Europe to Latin America to the Middle East in their quest to compete in the worldwide market. Each issue brings detailed analysis on technologies, products, companies and ideas that are on the most advanced edge of telecom innovation. Global Telephony delivers focused information on product innovations, expert analysis of network developments, ahead-of-the-curve coverage of technology advances and unique insight on the most crucial topics for leading network operators.

GRIC

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Gric Communications

Booth #114

GRIC™ Communications, Inc. provides convergent services platform technology (GRIC CSP), which enables services providers (ISPs, Telcos, and emerging carriers) to exchange and offer multiple value-added Internet-based services via a single intelligent system worldwide. Internet Services include IP Telephony, Prepaid Telephony, Global Internet Roaming and Faxing. Leveraging its GRIC Alliance Network, a worldwide membership of over 450 major ISPs and million dial-up users and an estimated 40 million corporate users.

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Website: www.gst.net

GST Telecom Hawaii

Booth #125

GST Telecom Hawaii Inc, an Integrated Communications Provider (ICP) located in Honolulu, provides a broad range of integrated telecommunication products and services including local dial tone, high speed Internet, long distance, collocation and enhanced data services. Facilities based GST established and built the Hawaiian Island FiberNet (HIFN) system. This submarine fiber optic network is Hawaii's largest and the first to connect all six major Hawaiian Islands. HIFN also includes a submarine connection between the international cable stations on the island of Oahu which allows GST the ability to cross connect to the major transpacific cable systems.

Whether your telecom service needs are statewide or global, GST is anxious
to become your telecom business partner. Contact GST at 808-791-1000 or
visit our website at www.gsthawaii.com.

The Guam-Philippines Cable System

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Website:
www.gpcc.com.hk

Guam-Philippines Cable Company

Booth #127—128

The Guam-Philippines Cable System was completed and placed into service in March 1999 by the private financing group G-P LP <PLDT, KDD-SCS, Tyco Submarine System, Kanematsu & Nichimen (Japanese Trading Firms as the major investors)>. The G-P Cable System is intended to route ever-increasing IP and voice traffic between the U.S.A. and the Philippines/beyond as well as Japan and the Philippines/beyond. The capacity of G-P Cable System is sold on an ownership basis to the telecom carriers and ISPs of the world.

Guam Philippines Cable Company on behalf of G-P LP to administer the construction, sales of capacity, operation and maintenance work of the G-P Cable System.

High Tech Hawaii

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HIGH TECH HAWAII

Booth #100—103

"High Tech Hawaii", a public-private consortium of economic development organizations, is jointly promoting Hawaii as a great place to conduct technology business. Compelling reasons for conducting tech business in Hawaii include: Hawaii's unique geographic and time zone advantages between the US Mainland and the Asia-Pacific region, Hawaii's world-class telecommunications network, Hawaii's educated and multicultural workforce, new technology tax incentives, and an unsurpassed quality of life. Business and investment opportunities exist in information technology/telecommunications, biosciences, medical/healthcare technologies, earth/ocean/space sciences, and defense and dual use technologies. Consortium members are the Hawaii Island Economic Development Board, Kauai Economic Development Board, Maui Economic Development Board, Economic Development Alliance of Hawaii, State of Hawaii High Technology Development Corporation, and the Hawaii Technology Trade Association.

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ICOM PUBLICATIONS

Booth #131

ASIAN COMMUNICATIONS offers a focused and potentially lucrative marketing opportunity for companies seeking high profile regional exposure. Addressing the needs of senior management, communications executives depend upon its timely relevant and independent editorial. Our ability to respond accurately to the ever-evolving communications market ensures that ASIAN COMMUNICATIONS remains the NUMBER ONE INDUSTRY MAGAZINE.

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iAsiaWorks

Booth #49

iAsiaWorks is a leading Internet data center (IDC) and hosting services provider across the Asia-Pacific region. With IDC facilities in 11 Asia-Pacific countries and Silicon Valley, we offer one-stop-shopping for superior hosting services in Australia, China, Hong Kong, India, Korea, New Zealand, the Philippines, Singapore, Taiwan, Thailand, and the United States.

International Engineering Consortium

Booth #1

The International Engineering Consortium (IEC) is a nonprofit organization dedicated to catalyzing positive change in the information industry and its university communities. Since 1944, the Consortium has provided high-quality educational opportunities for industry professionals, academics, and students.

To support a worldwide need, the IEC has developed free on-line Web-based tutorials.
All are professionally edited and peer-reviewed by experts from the information industry and academia.

It also conducts research and develops publications, conferences, and technological exhibits addressing major opportunities and challenges of the information age. A wide range of professionals from business and academia rely on the IEC each year, including senior business and marketing executives, engineers, technicians, and professors.
The IEC conducts industry-university programs that have substantial impact on curricula. More than 70 leading, high-technology universities are currently affiliated with the Consortium. Industry is represented through substantial corporate support and the involvement of many thousands of executives, managers, and professionals.

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Intele-CardNews

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Intele-CardNews

Booth # 109

Since the inaugural issue in June 1995, Intele-CardNews has become the definitive resource within the $4 billion + prepaid and smart card industry. By delivering vital information and timely news, we have become the leader in the market–and the only monthly publication devoted to the prepaid and smart card industries.

More than just a magazine, Intele-CardNews serves every need in the marketplace. The
debut of our quarterly international edition, Intele-CardNews International marked the
first expansion of a U.S. prepaid telecom publication into the global marketplace. With the rapidly changing landscape of prepaid, Intele-CardNews responded with our web site at www.intelecard.com and our bi-weekly e-mail news source, ICNwire–immediate, vital information that captures the attention of decision-makers daily.

A vital resource for readers in the retail and promotional markets alike, Intele-CardNews delivers your marketing message into the hands of marketing managers, brand managers, buyers, business executives, advertising and promotional agencies, premium and incentive purchasers and entrepreneurs.

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Interoute Telecommunications

Booth #89

Interoute is a rapidly growing, vertically integrated, pan-European telecommunications company with established operations in 12 European countries and the USA. The company sells a range of telecommunications services, from network infrastructure, such as dark fibre and co-location, to end user services, such as telephony.

Interoute is behind the largest telecommunications project in Europe today — the construction of the i-21 fibre optic network, connecting 46 cities in 9 countries with around 14,500 route kilometres of fibre.Interoute is already a major presence in the wholesale voice market, selling to over 70 other carriers and service providers around the world. It also sells telephony services to residential and business customers across Europe, and is a leading provider of calling cards.

INTELSAT

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INTELSAT

Booth #85—86

INTELSAT owns and operates a global satellite system, which provides video and voice/data services to users in more than 200 nations, territories, and dependencies on every continent. Founded in 1964, INTELSAT was the first organization to provide global satellite coverage and connectivity, and continues to be the communications provider with the broadest reach and the most comprehensive range of services.

INTELSAT's family of Internet services offer global Internet access using a wide variety of earth station sizes, including VSATs. INTELSAT gives customers pre-engineered Internet solutions, supported by INTELSAT's world-renowned expertise in service implementation, and include a wealth of technical support materials, facilitating rapid service implementation anytime, anywhere.

At PTC 2001, INTELSAT will present its latest product Broadband VSAT, offering a cost-effective and rapidly deployable networking solution for data, voice, multimedia and high speed Internet using IP, Frame Relay, ATM, ISDN or SS7 services.

The INTELSAT managed network offers dynamically assigned bandwidth with guaranteed quality in C-and Ku-band and provides value-added services in the form of network management and control, as well as billing record generation and technical planning. Broadband VSAT, based on Comsat Laboratories' LINKWAY platform, provides a cost-effective networking solution for service providers serving the corporate network and internet backbone markets. Typical applications for Broadband VSAT services are corporate networks with WAN and LAN interconnections, video-conferencing, multicasting, tele-education or tele-medicine applications and thin-route ISP backbone access.

For more information, visit the INTELSAT web site at www.intelsat.int.

IP Access International

Booth #30

IP Access International, (IPA) is the leading independent "Best of Breed" solutions provider of voice, video and data over satellite. With the assistance of Advanced Projects International (API), our sister company and world-renowned consulting, integration and testing lab, IPA is able to test, certify and recommend the best available options for a customer's particular application.

As numerous Teleports, Telco's, and ISP's have discovered, strategic IPA/API solutions can save thousands of dollars and ensure an open architecture with the ability to leverage not only the technologies of today but the technologies of the future.
Through very open relationships with all of the leading DVB manufactures, our companies are able to test products while they are still in the beta stage. So stop by booth 30 and allow us to show you what's hot, what's not and what's coming next.

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iSoftel
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Website: www.isoftel.com

iSoftel

Booth #53—54

iSoftel, has been a leading international platform provider since 1998. Offering next-generation carrier solutions for a changing telecommunications industry, iSoftel is one of the few companies to offer true flexibility, scalability and functionality. Unlike the majority of available prepaid/postpaid platforms, iSoftel offers a fully comprehensive prepaid/postpaid solution. Features include tandem switching, multiple classes of service, such as prepaid calling card, postpaid calling card, international callthru and callback, one number service, call center solutions, unified messaging, voice VPN, pre-demand/on-demand information services and multiple languages.

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Japan Asia Network Consulting Co., Ltd.

Booth #122

We are providing global carriers with our expert services for market study, license, recruiting partners and others in Japan, China and South East Asia. More information is available through our Web site http://www.asianet.co.jp

JSAT Corporation

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JSAT Corporation

Booth #80—81

JSAT is a leading satellite operator in Asia with the largest fleet, and it has been an innovator of satellite based multimedia business ever since the company was founded in 1985.

To offer high-quality superior service and excellent reliability, JSAT operates eight satellites in seven geosyncronous orbits, one being a fully equipped back up satellite. Onboard Ku and C-band transponders have coverage of most of Asian region.
JSAT made available two highly advanced satellites, JCSAT-3 and JCSAT-4 for the first Japanese communication satellite (CS) digital broadcasting system. Began operation in October 1996, SKY PerfecTV!, provides the multichannel age with variety-filled programming that can be selected from 300 channels. In April 1998, JSAT established NTT Satellite Communications Inc. in conjunction with telecommunication career NTT to provide internet access service and intranet service via satellite. Internet service subscribers can receive information at high speed from JCSAT-4 satellite.
As the pioneering firm in the Japanese satellite business field, JSAT is pledged to utilize its know-how and continue its efforts toward realization of the satellite infrastructure of the 21st century.

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Kapolei Hawaii

Booth #116—117

Kapolei: Hawaii's e-City
Technologically Smart. Globally Connected.

Kapolei, Hawaii on the island of Oahu. It's a city for people with prospects. Totally wired for global commerce. Connecting companies to major markets anywhere in the world. Time zones that span the Americas and Asia for same-day communications. Business-friendly with aggressive new tax incentives. Good jobs for forward-thinking people. A lifestyle second to none. A city like no other. Kapolei, Hawaii's e-city.

Website:
www.kapolei.com

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KDD-SCS

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KDD Submarine Cable Systems Inc. (KDD-SCS)

Booth #6—7

We bring the dreams of people around the world together with technology. KDD-SCS Optical-fiber submarine cable connects our world, and building those links of light is the business of KDD-SCS. As a result of the explosive growth in demand for Internet and other data-intensive telecommunications, the construction of international information highways and the establishment of networks with expanded capacity have become global imperatives. As one of the very few companies in the world capable of providing total solutions, our mission is to fulfill this need. From design and construction to maintenance, we use our state-of-the-art technology to deliver systems of the highest quality and reliability. Taking full advantage of our specialization in submarine cable systems, KDD-SCS is serving the world as a leading global system integrator. www.kddscs.co.jp

KMI CORPORATION

KMI
World Leader in Fiberoptics Market Research

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KMI Corporation

Booth #119

KMI Corporation is the world leader in fiberoptics market research. KMI's services enable fiberoptics and telecommunications companies to anticipate trends and competition in the industry's market sectors. A sister company of PennWell, and part of the Advanced Technology Division, KMI's commitment is to provide clients with actionable reports and marketing tools that are targeted, cost-effective and time-sensitive. KMI provides the information to succeed in telecommunications.

KMI's services include:

Website:
www.kmicorp.com

- Market research reports
- Market data by region, component and technology
- World-wide and specific regional forecasts
- Network feasibility studies
- Conferences
- Electronic News Services
- Fiberoptic Route Maps
- Undersea Systems analyses
- CD-ROMs and databases
- Fiberoptics Marketing Intelligence Newsletter
- Global Network Locator

Located in Newport, Rhode Island, KMI has provided services for telecommunications leaders, such as AT&T, BT, NTT and the Bell companies, as well as global manufacturers of optical fiber, cable, transmission equipment and components. KMI has completed projects for industry groups and consortia such as the European Community and FLAG.

Lockheed Martin Global Telecommunications

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Lockheed Martin Global Telecommunications

Booth #12—13

LINKWAY is delivering the future today with Broadband VSAT networking using existing satellite capacity in the Ku- and C-Bands. LINKWAY is today's best value for seamlessly extending IP, ATM, F/R, ISDN and SS7 terrestrial networks.

LINKWAY has clear advantages over the existing VSAT systems in the marketplace. Its features include a hub-less architecture, multiprotocol support enabling easy migration to emerging applications, support for asymmetric traffic, and single-hop "full-mesh" and "star" topologies on a single platform.

LINKWAY's unique patented dynamic Bandwidth-on-Demand algorithm distributes the network bandwidth among many sites effectively and efficiently on demand. It supports "multiple gateway" network architectures without utilizing a hub, for networks where the wideband content is provided from various destinations

Communication via satellite is now accessible to a much broader and rapidly expanding international market for Internet and multimedia applications, with the commercially priced, modular design of LINKWAY VSAT's. Its flexibility serves a variety of customers, including carriers, WLL's, ISP's and multinational corporations, as an essential networking tool for applications such as Intranets, INTERNET, videoconferencing and collaborative computer design.

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Min-X.com

Booth #10

Min-X.com was launched in 1998 to provide a web-based, central marketplace for VoIP provider to find each other and conduct business. Since then Min-X has evolved into a full service brokerage for telecom capacity.

Min-X is dedicated to providing its community of members and users, tools for price transparency, credit risk management, and e-commerce. The Min-X website is a vertical portal for telecom executives who are responsible for researching and transacting buy and sell decisions for capacity. Dedicated Min-X brokers are able to help buyers and sellers identify value and structure deals that are business savvy, and risk adverse.

Min-X has helped hundreds of companies discover new alternatives for exchanging capacity. Visit our website or stop by our booth #10 to find out how a Min-X broker can help you sell excess capacity and identify the right channels for buying capacity.
The Min-X community is over 2000 strong, and growing rapidly. With over 1500 deals listed, Min-X is the leader in providing viable options for your capacity needs.

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Fax: 886.02.2696.3396
Website:
http://www.mky.com

Mackay Telecommunications Inc.

Booth #64

Founded in 1992, MKY is a leading value-added telecomm service provider in the Taiwan-China markets today. With network covers all major cities in Taiwan, the USA, The Philippines, Australia and Hong Kong, our services include:
Co-location and facilities management, which already assisted several foreign operators expanded to Taiwan. Fax services. Fax-to-fax, Internet fax, and business-managed fax, which incorporates local lease lines, high-speed scanners and MKY's proprietary software.

Voice service for corporate internal use.
Data services (frame relay).
Dedicated Internet accesses for businesses and virtual hosting.
Network integration and unified network.
MVX, a PC-based switch, running SS7/C7.
VoIP gateways. SmartStation for enterprise users and SmartHub for operators.

MKY has successfully grown into a force of 200 professional people today. The unrivaled performance, in terms of our consistent profitability and steady growth, is due to our emphasis on the quality of services and ownership of proper technologies and network capabilities. Looking ahead, MKY will remain on the cutting edge of the Taiwan and China markets.

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Website:
www.motorola.com

Motorola

Booth #71—72

Motorola is a global leader in providing integrated communications solutions and embedded electronic solutions. These include:

Software-enhanced wireless telephone, two-way radio, messaging communications products and systems, as well as networking and Internet-access products, for consumers, network operators, and commercial, government and industrial customers.

Embedded semiconductor solutions for customers in networking, transportation, wireless communications and imaging and entertainment markets.

Embedded electronic systems for automotive, communications, imaging, manufacturing systems, computer and industrial markets.

Digital and analog systems and set-top terminals for broadband cable television operators. Please stop by the Motorola booth to learn about Motorola's technology including the Motorola WAP Gateway, the Motorola Voice Gateway, easy to use development tools, and our display of messaging devices, two- way radios, and mobile phones.

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Website:
www.multacom.com

Multacom

Booth #113

Multacom is a privately held corporation based in City of Industry, California, and operates an OC-3 ATM broadband backbone network throughout the United States and China. Multacom has established strategic partnerships with several proven successful service providers and with these partners has access to 43 data centers spread throughout the USA, Taiwan and China. In addition, Multacom has its own data centers in Los Angeles and San Jose, California. Besides Colocation in its data centers, Multacom offers comprehensive e-business solutions, including high speed Internet access, web hosting services, VPNs, and web development. Multacom's primary market today consists of businesses in the United States with a need for access to the markets of

Taiwan and China. Multacom plans to expand its services to the rest of Asia, Europe and Latin America in the near future.

MultiDynamics

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MultiDynamics

Booth #63

20-year old MultiDynamics, Inc. produces Bi-model Information Transfer Systems (BITS) for utilization by telecom equipment and software vendors, service providers, and end-users in the specialized telecom areas of DSL, WDM, MPLS, and OSS. A virtual company with affiliates in New England, Virginia, Texas, and California, its products find applications on a global basis.

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Website: www.nact.com

NACT Telecommunications

Booth #3

NACT designs, manufactures, and markets fully integrated telecom applications switching systems for long distance companies, resellers, and specialty network operators. NACT systems are a complete solution for services such as prepaid calling cards, VoIP, automated operator, standard long distance, home 800 reselling, 10-10-XXX, and more.

NACT's STX is a Class 4, full-feature tandem switch expandable up to 8,000 ports. NACT's NTS 2000 is a complete, user-friendly billing/OSS package that can interface to the STX or any other switching system. The NTS offers multi-currency capability, custom reports, context-sensitive help, and a fully ODBC compliant Informix database.

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National Exchange Carrier Association

Booth #79

Formed in 1983 by the Federal Communications Commission (FCC) as a not-for-profit membership corporation, NECA plays an important role in administering the FCC's access charge plan — a plan that helps ensure that telephone service remains available and affordable in all parts of the country. Through its corporate family, NECA adminsters numerous nationwide programs. The Universal Service Administrative Company (USAC) administers programs that provide support for telephone companies with inordinately high costs, and assistance for low income subscribers by reducing or waiving fees necessary to get on the phone network and stay connected.

Independent NECA Services (INS), another NECA subsidiary, adminsters billing and collection programs through which the telcos receive compensation for billing long distance calls on behalf of interexchange carriers and operator service providers. In addition, they provide assistance to international entities, which may include foreign nations, corporations and organizations. INS provides information and analysis related to telecommunications, universal service, interconnection and other related services

Net2Phone

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www.net2phone.com

Net2Phone

Booth #61

Net2Phone is a leading provider of voice-enhanced Internet communications services to individuals and businesses worldwide. Net2Phone enables people to place low-cost high quality calls from their computer, telephone, or fax machine to any telephone or fax machine in the world. Net2Phone develops and markets technology and services for IP voice and e-commerce solutions for the web and other IP networks.

NeTrue Communications, Inc.

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NeTrue Communications, Inc.

Booth #24

NeTrue Communications Inc. (NTU.U: CDNX) is a publicly traded California-based IP telephony solutions provider with core technical competencies in QoS management, network management and clearinghouse technology. NeTrue IPT BackOfficeTM and NeTrueQoS provide integrated operation and management support for IP voice networks, supporting multiple hardware platforms including Cisco and Lucent. NeTrue's IPT BackOffice' allows next-generation carriers and service providers to effectively provision, settle, bill and manage IP telephony services.

NeTrue Vipersat Networks Division develops and markets IP over VSAT technology. NeTrue's Commsent Solutions provides traffic management; clearinghouse and routing services to a global network of more than 85 communications providers. NeTrue Communications Inc. can by found at www.netrue.com.

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NetSat Express

Booth #D

NetSat is a world leader in the provision of satellite-based Internet access services. Over the last three years, we have expanded our business to included ISP's, carriers and cable companies in over 25 countries. Our worldwide teleport network can provide access to networks in almost every country.

NetSat Express also provides ASP services, which include outsourced hosted solutions for e-mail messaging and advertising banner management. These ASP services are based on a unique framework which is adaptable and expandable to include a variety of solutions. These solutions are housed in our state-of-the-art New York hosting facilities.

NetSpeak Corporation

Booth #16-17

NetSpeak provides intelligent call management software and enhanced applications for global scale Voice over IP (VoIP) networks. Based on the company's industry leading iTEL Architecture, NetSpeak's Infrastructure Gatekeeper and Route Server provide the industry's most efficient call routing and call management for service providers who want to get the most out of their network resources. To allow providers to scale their networks to global size, the NetSpeak Interconnect Gatekeeper and Route Server allow the interconnection of multiple network domains, including those controlled by non-NetSpeak gatekeepers. NetSpeak Application Gatekeepers and suite of enhanced applications provide the value-added solutions that service providers need to grow their businesses, including Voice VPN, PC-to-Phone, Internet Call Waiting, Voice E-Commerce and 800 Services. See us on the web at www.netspeak.com or visit us in booths 16 & 17.

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Network Access Solutions

Booth #112

Network Access Solutions (NAS) is one of the premiere wireless Wide Area Network (WAN) and Local Area Network (LAN) integrators in the country. NAS provides complete site surveys, network designs, equipment sales, installation, training and follow-up maintenance for wireless data networks. NAS specializes in developing wireless networks for Law Enforcement, Government, Education, and Commercial applications.

NAS owns and operates wireless ISPs nationwide, providing business and consumer high-speed access to the Internet.

NAS also provides professional consulting for the Information Technology (IT) industry. The IT consulting NAS provides includes Business Development for Strategic Planning; Management of Infrastructure, including hiring, training, and supervising employees; Project Management; Implementation Support for new operations or functions; Telemarketing; Contract Management; and Technology Platform Selection, Design and Implementation.

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Next Level Communications

Booth #32

Next Level Communications is an industry leader in developing and supplying a single access platform to address the many strategic service and deployment issues facing the local exchange providers. Next Level supplies the world's first fully integrated unified access platform to economically support Interactive Broadband DSL Services over copper twisted pair.

Products
Next Level provides Nlevel3–The Unified Access Platform™. This fully-integrated system provides Digital Loop Carrier, Fiber-to-the-Curb (FTTC), Fiber To The Node (FTTN), Digital Subscriber Line Access Multiplexer (DSLAM) and full-service broadband access capabilities for

the delivery of voice, data and video services over fiber optic and copper twisted pair networks. Next Level also provides broadband management systems and customer premises equipment (CPE) for both high speed data and video services. The advanced features and unique integrated design of the system gives service providers an economic, future-proof strategy for deploying traditional telephone
services as well as advanced data and video services.

One access platform. One broadband solution. All delivered by Next Level, an industry leader in integrated voice, high-speed data, and video.

NEW SKIES SATELLITES NV

Booth #132—133

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Website: www.newskies.com

New Skies Satellites NV is a global satellite communications company providing video, Internet, voice and data communications services to a range of broadcasters, Internet service providers and telecommunications carriers around the world. New Skies is headquartered in The Hague, The Netherlands and has offices in Singapore, Washington D.C, Sydney, London, New Delhi and São Paulo. The company began operations in November 1998 as a commercial spin-off from INTELSAT.

New Skies operates a fleet of five satellites in the Pacific, Atlantic and Indian Ocean regions, providing a complete global coverage at C-band, and high powered Ku-band spot beams over most of the world's principal population centres. These are established and reliable satellites operating at excellent orbital locations. NSS-513 is one of the few satellites that can connect North America with all major destinations in the Asia Pacific in one single hop. NSS-6, a high-powered Ku-band and Ka-band broadband multimedia satellite designed for intra-regional networking is planned for launch during 2002 to augment existing coverage of Asia.

Nuera Communications

Booth #90

Nuera Communications, a top-rated Voice over Internet Protocol infrastructure provider, develops packet-voice telephony solutions for carriers worldwide. The company's Open, Reliable Communications Architecture–ORCA–enables seamless voice traffic transport between the Public Switched Telephone Network and packet networks. Nuera also is developing the ORCA SSC Softswitch, a software-based switch that will help companies migrate from traditional switching into a broadband environment.

Nuera is one of the industry's pioneers in the adoption of interoperability standards such as MGCP and SIP and is a founding member of the International Softswitch Consortium.

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NTT Communications

Booth #73—74 / #82—83

NTT Communications is one of the world's largest telecom carriers with over one hundred years' experience as the leader of Japan's telecommunications industry. Since its reorganization in 1999, NTT Communications has set itself a goal of becoming a "Global IP Company" and has been expanding services through global partnerships to meet ever-increasing business requirements using the IP network. One example is the acquisition of Verio, an ISP with a high capacity IP network in the US, which enabled the development of the One IP Network with global coverage, the Data Center Service and other IP-based services.

With operation in 53 countries, we provide simple, one-stop shopping solutions for a full range of global communications services under one brand: Arcstar.

For more information, please visit us at stand #73,74,82,83 and at www.ntt.com/world

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Orblynx Inc.

Booth #77

Orblynx is a high technology company specializing in the development of Internet content distribution solutions. Using state-of-the-art satellite technologies, Orblynx developed IDS2000, a unique multicast distribution system that enables ISPs and carriers to save bandwidth and provide better, faster service to their customers. The next generation of Internet content distribution, IDS2000 delivers web content, newsfeeds and streaming media to customers around the globe using satellite networks–a cost effective, global solution to the "World Wide Wait."

faster global internet™

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OTelNet Inc.

Booth #15

OTelNet's high-performance software infrastructure bridges the gap between mobile and Internet subscribers, and the content and services they demand. Our solutions address key challenges that wireless service providers, mobile portals, and mobile ASPs alike face–to provide tailored information precisely when and where their subscribers need it.
With OTelNet scalable solutions, providers can create and deliver innovative services–quickly and cost-effectively, while protecting their existing investments. An application can start small and grow big in the same high-performing, reliable environment. OTelNet software and technology are based on industry standards and interoperate easily with existing infrastructure.

Our solutions enable a full range of highly personalized, sophisticated mobile data services–dynamically managed, and delivered through any

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Web-enabled device. Subscribers can access their services in real time, when and where they like.
Only OTelNet provides both subscriber presence and notification capabilities, laying the groundwork for the killer wireless Internet applications of tomorrow.

OTelNet brings Speed and Smarts to the mobile Internet!

OTL
Software

OTL Software Limited

Booth #75

TelStream

Advanced Customer Care and Billing

This flexible package offers an affordable solution which combines Unix reliability, performance and scalability in the engine room with contemporary Windows/NT architecture in the office. Seven modules integrated over a common customer database deliver a first class solution with the flexibility to adapt to a wide range of customer requirements.

Modules encompass a switch mediation, rating, billing and settlement pipeline integrated with customer process management, debtors, faults and cable infrastructure. These modules are engineered and delivered to suit the needs of small to medium nations and focused service providers.

Existing users in the Pacific are enjoying the benefits of this fully supported software on modest budgets. All modules may be used on a fully integrated basis or specific point solutions can be delivered by selecting appropriate modules. First class implementation and on-going support services complement this advanced software.

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PacAmTel

Booth #A

PacAmTel owns and operates a facility for satellite communications, located near Hemet, California–about 70 miles southeast of Los Angeles.

With equipment facilities of over 6000 square feet, and antennas on major satellites in the Pacific rim and Central and South American arenas, PacAmTel can offer direct satellite communications services to over 80 percent of the world's population.

PacAmTel also has direct, wide-bandwidth communication links to One-Wilshire, in downtown Los Angeles. One-Wilshire is the main telecommunications interconnect point on the west coast of the U.S. In addition, major Internet backbone providers have installed routing equipment at PacAmTel's facility, allowing customers immediate access to high-speed Internet connectivity.

PacAmTel is owned by q-east, a provider of wide-band communications services in the Far East area.

pacific star
communications

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Pacific Star Communications

Booth #60

Pacific Star Communications, delivers and supports advanced telecommunications equipment worldwide. We carry over 200 lines of the world's best telecommunications equipment. This ranges from the most prominent providers, such as PairGain/ADC Telecom, Enterasys/Cabletron, Alcatel and P-COM, to new and exciting providers such as Jetstream and Redback.

While we carry equipment for all applications, we specialize in supporting customers that are:

- Making the transition from analog to digital (such as DSL)
- Expanding their local loop capabilities through terrestrial or wireless networks
- Migrating to IP services and capabilities

Our service credo is "Serve the Customer."

To us, this has four key elements:

- Respond immediately
- Always be dependable
- Be friendly and easy to work with
- Provide knowledgeable support

There is nothing high-tech about these qualities, but they are the key to our success and growth. We pledge that these qualities will be the center of our relationship with you

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Packetport.Com

Booth #98—99

PacketPort.com, Inc. a leader in enabling bundled services over broadband, provides IP Telephony solutions and services for a wide range of telephony applications for the Internet, telecom and other data networking industries, based on the flexible packet gateway architecture. PacketPort.com has launched a complete line of Voice-Over-Broadband products. Extending the capabilities of DSL, cable, wireless T1, E1 and SS7/C7 service, PacketPort.com provides a variety of bundled services, including multiple lines of Voice and Fax-over-IP, in addition to high-speed Internet access.

PacketPort.com's products are sold to International Carriers, Internet Service Providers and Next Generation Telcos.

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PHONE+ International

Booth# 84

Published 12 times a year, PHONE+ International delivers information that's vital to all participants in global telecommunications, including carriers, resellers, agents and enhanced service providers of every stripe as well as their investors and suppliers. PHONE+ International offers news and analytical coverage across the full range of topics comprising the worldwide explosion in telecommunications.

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Pihana Pacific

Booth #126

PIHANA Pacific is building a broad geographic presence throughout the Asia/Pacific region. The PIHANA neutral data centers serve the whole Internet community by combining secure, world-class co-location facilities with state-of-the-art integrated Internet Exchanges. PIHANA's absolute neutrality provides choice and inspires customer strategic interaction within the open market environment of its IX-enhanced data centers.

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Pirelli

Booth #110

Pirelli experience in underwater telecommunications dates back to 1886 when the first submarine telegraphic cable was installed by the vessel "Citta di Milano 1" connecting Massaua to Assab and Assab to Perim in Africa. Since those years Pirelli contribution to the submarine telecommunication networks was remarkable both in domestic and international waters. Today Pirelli provides complete turnkey systems based on the highest technology standards in the field.

Domestic, international and intercontinental submarine networks are used to interconnect different locations where the information is generated and distributed with an increasing demand of bandwidth and reliability. Very long distance transmission links (networks) are cost effectively covered by optical submarine systems with the advantages to achieve a superior quality than any other carrier.

Pirelli Submarine Telecom Systems is the Company in the Pirelli group dedicated to
the development, design, manufacture and installation of submarine optical systems. The Company supplies complete turnkey submarine systems.

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pulver.com

Booth #11

Jeff Pulver founded pulver.com in 1994. pulver.com produces the highly successful
Voice on the Net conferences. It is also engaged in many activities that promote growth in communication technology using Internet protocol. pulver.com builds community for the Internet Telephony industry through conferences, newsletters, mailing lists, analysis, liaison roles, advise to start-ups, summits, test projects and web content. pulver.com provides community and thought leadership for the IP Communications Industry.
The Pulver Report is a widely-read source of information on the latest development in streaming media with a focus on IP Telephony. There are currently over 50,000 subscribers.

Implementation projects include the Pulver Open Test Network, a completely open environment for companies to test interoperability, and pulverradio the first B2B 24X7, Internet-based, rock-oriented radio station with Internet/Telecom content.

The pulver.com website (http://pulver.com) is a key source of information for those in the IP Telephony industry, with product guides, company listings, past Pulver reports, archives of mailings, and job postings.

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Quintum Technologies, Inc.

Booth #65

Quintum Technologies, Inc. offers enterprises a VoIP solution that provides risk-free migration to converged networks. Quintum is a privately-held corporation headquartered in Eatontown, NJ. The company's VoIP products are designed to high telephony industry standards and are supported with a 100% connection reliability guarantee. The company delivers VoIP solutions that provide:

- Outstanding value to enterprises and service providers
- Ease of installation, use and management
- Superior quality and reliability
- Open architectures and standards compliance
- Flexible migration to succeeding generations of convergence technology

VoIP Made Easy! RISK-FREE VoIP migration with Quintum's new Tenor™ MultiPath VoIP Gateways, the only gateways with multi-path architecture for effortless installation and development. TASQ™ Technology intelligentlly and transparently switches calls from IP to PSTN during calls, ensuring high quality voice and failsafe reliability. The Tenor Gateways are standalone units and are H.323 compliant gateways with integrated gatekeeper, border element and PacketSaver multiplexing functions. Each unit supports analog, T1/E1/PRI and fractional T1/E1/PRI environments.

Qwest

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Qwest Communications/PHONE+ International

Booth #84

Qwest Communications International Inc. (NYSE: Q) is a leader in reliable, scalable and secure broadband Internet-based data, voice and image communications for business and consumers. The Qwest Macro Capacity Fiber Network, designed with the newest optical networking equipment for speed and efficiency, spans more than 104,000 miles globally.

RateXchange

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RATEXCHANGE

Booth #78

RateXchange Corporation operates the leading electronic trading system that allows market participants to trade bandwidth. The Company provides global trading solutions to telecommunications companies, energy merchants, financial institutions and commodity traders, with RateXchange's advanced technological platform providing users with an efficient, centralized marketplace to bring buyers and sellers together. Through the development of marketplaces for financial instruments, RateXchange is bringing risk management tools and practices to the communications industry. The Company has deployed neutral delivery hubs that provide a secure infrastructure for facilitating the delivery of traded bandwidth over any platform. By providing market participants with an advanced electronic trading system, financial products and an independent delivery mechanism, RateXchange is enabling the creation of a liquid bandwidth trading market.

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Redcom Laboratories, Inc.

Booth #37—38

REDCOM designs and manufactures digital telecommunications systems based on its patented distributed control architecture.

The International Gateway Access Transit Exchange (IGATE®) reconciles differences in transmission, signaling protocols, and numbering plans between networks.

The ISDN Gateway Exchange (IGX), with PRI and BRI, can serve many applications (CLEC, command center, rapid response, class 5 central office, etc.) Advanced cluster technology, several operator consoles and an optional CTI link are available for special applications.

The Tactical Communications Package (TCP) is a fully integrated, highly portable, deployable communications system designed with rugged, industry standard connectors and support for a wide variety of domestic, international and government interfaces.

The Modular Digital Exchange (MDX) or Community Digital Exchange (CDX-5+) offers many capabilities, including SS7, Caller ID, CLASS Features, and flexible dialing plans.

The Modular Switching Peripheral (MSP) is controlled by a Host Computer. The MSP Host Toolkit (provided in ANSI C source code) increases the productivity of developers.

The Small Business Exchange (SBX) Family includes office systems, tandem repeaters
(TRX), power line systems (PSX), and command centers (DCCX).

The TeleTraffic Generator® (TTG®) is a bulk call generator and traffic load system that is flexible enough to accommodate the most rigorous test requirements

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RevCom Inc.

Booth #45

RevCom is a turnkey supplier of satellite and wireless communication systems. We offer a full range of services for the design, integration and installation of satellite and wireless communication networks.

With our line of ETX‰ and DVX‰ satellite earth stations and terrestrial wireless systems we provide a complete end-to-end solution for your data, voice and video communication needs. Our customers include domestic and foreign telecommunications carriers, ISP's, broadcasters and private network operators.

RevCom's focus is on the growing demand for satellite and wireless communications infrastructure in countries around the world. Our team of professionals has completed more than 400 projects in over 120 countries.

With proven expertise in the design and installation of satellite and wireless communications systems for all types of applications (including international telephony, VSAT networks, rural telephony, Internet, VOIP, military networks, video broadcast facilities and SNG), we can handle your most demanding requirements on time and on budget.

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Satellite Broadband/Global Telephony

Booth #96—97

Satellite Broadband is a monthly magazine that provides 21,000 ISPs, broadcasters and network operators with the real world benefits and economics of satellite solutions for broadband. It offers readers insight on how to improve their businesses through the use of satellite technology. Editor/Publisher: Amy Cosper +1-720-489-3196, amy_cosper@intertec.com

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Singapore Exhibition Services

Booth #129

SES has been organizing top industry events since 1975. A member of the Montgomery Network with offices in more than 30 countries, together the group today organizes more than 200 exhibitions worldwide. SES has built up a comprehensive portfolio of more than 36 trade shows, including CommunicAsia, which has now grown to become Asia's largest IT and Communications event since its inception in 1979.

CommunicAsia2000's hugely successful staging in June saw some 2,108 participants occupying a massive 68,350 sqm. A total of 46,426 trade visitors coming from 52 countries were at the event, making it one of the best-attended events of its kind in Asia.
CommunicAsia2001 will be held from 19—22 June 2001 at Singapore Expo. It is to return with a bigger show than ever. One can expect to view the latest products and services, and meet the crème de la crème in the IT and communications industries. Also at CommunicAsia, the only major international networking event with a finger on the pulse of the Asian Info-Comms industry — CommunicAsia2001 Summit. The summit will feature four Specialist Conferences, including Asia-Pacific Satellite Communications Specialist Conference, a powerful international gathering of top names in the satellite communications industry.

Pulsating and dynamic, CommunicAsia is definitely the one, total IT and communications event in Asia. Be at CommunicAsia2001. The future–Today.

SPACE NEWS

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Space News

Booth #120

Space News is the global publication of record for the space community. Space News plays an essential role in worldwide space, providing fresh news, critical insight and a common communications forum for the worlds' space leadership. Space News is the only weekly dedicated to global space activities, technologies, trends, business, environment and majorprograms. We cover space policies, political & legislation, NASA, ESA & space agency programs, satellite communications, new products & advanced technologies, interviews with worldwide space leaders, satellite manufacturing, operation & applications, remote sensing and space exploration activities. Please visit the Space News booth and sign up for a free subscription.

SSA

Strategic Service Alliance, Inc.

Booth #59

Strategic Service Alliance, Inc. (SSA) is the leading source for communication platform solutions, providing the most advanced call transaction processing systems for the telephony and Internet industries worldwide. Our platforms support Internet Access Control, prepaid & metered Internet, prepaid calling cards, wireless and wireline applications.

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Switch & Data Facilities Co

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Switch & Data Facilities Co.

Booth #22

Switch & Data Facilities Co. (S&DFC) operates an international network of carrier-neutral, shared-infrastructure colocation facilities, offering ISPs, ASPs, CLECs, data storage companies and telcos flexible, economical space arrangements and customized support services.

S&DFC's customers are seeking to avoid dependency on the facilities of a carrier/potential competitor and are capable of managing their own connectivity and bandwidth. By locating in an S&DFC facility, customers maximize transport options, minimize capital expenditures, and gain speed to market all while guaranteeing the utmost in flexibility.

Switch Management

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Switch Management Corp

Booth #123

"Switch Management is a provider of OSS software and online services to international telecom carriers. Our products include a 100% Web-based wholesale billing service (WebCDR), and a real-time QoS monitor and alarm manager (Switch Watchdog) for switches and gateways used by internationalcarriers.

Based in Oakland California, we are dedicated to producing innovative software solutions that help international carriers manage their traffic. As a spin-off from a 214 carrier, we have experienced first-hand the operational challenges that face the international carrier, and our products reflect this.

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Syracuse University School of Information Studies

Booth #62

Syracuse University School of Information Studies offers a dynamic Master of Science in Telecommunications and Network Management (TNM) in both distance learning and on campus formats. The TNM program offers students a comprehensive overview of networking technologies in data, voice, broadband multimedia and wireless, and an analysis of their applications in business and non-profit organizations. The TNM program prepares students as professionals who have the ability to combine knowledge of technology with an understanding of communication markets, management principles, and user behaviors. The School also offers nationally ranked master's degrees in Information Resources Management and Library Science in distance learning and on campus formats. Please visit our website at http://istweb.syr.edu or contact us at 315-443-2911.

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Telecom Asia

Booth # C

Telecom Asia is the world's leading magazine for Asian telecommunications professionals. With 25,000 BPA—audited circulation, it gives readers the latest information on technological, business and regulatory developments within the Asia-Pacific telecoms community. Wireless Asia is dedicated to the needs of those telecoms professionals responsible for the purchase and specification of wireless, mobile and satellite communications technology. It circulates to 15,000 readers. Telecom China is written for over 15,000 telecoms professionals responsible for the planning, design and implementation of the PRC's fast evolving public and private networks.

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Tekelec

Booth #21

Tekelec is a leading developer of telecommunications signaling infrastructure, diagnostic solutions, and service applications that enable telecommunications carriers and equipment suppliers to achieve benefits of packet-telephony revolution, while keeping service quality and feature richness intact. Tekelec's solutions are deployed in traditional and next-generation wireline, wireless, and IP voice, and data communications networks.

Tekelec's EAGLE STP is a fully distributed, high-speed, fault-tolerant, packet-switching platform that facilitates revenue-generating intelligent network. The EAGLE STP's unique architecture features a capacity to scale from 850 to over 60,000 transactions per second with connectivity for two to 7,000 ports. Tekelec's IP7 products utilize SS7 signaling over IP, resulting in a dramatic increase in efficiency and a reduction in latency. The VXi Media Gateway Controller (MGC), Tekelec.

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Telemobile Wireless Communication Solutions

Booth #46

TELEMOBILE Inc.–Wireless Communication Solutions (www.telemobile.com) is a US ISO9001 registered WirelessRuralLoop/Wireless LocalLoop (WRL/WLL) company manufacturing digital and analog PHONELINK® rural radio telephone systems for point-to-point and point-to-multipoint requirements.

Wireless Systems for Voice, Fax and Data. ANYWHERE!

Systems for wireless internet access, voice, fax, data are built to match your requirements. "Turn-key" wireless telecom systems and wireless RET (RoadsideEmergencyTelephone) CALLBOX systems are available in VHF and UHF frequencies, 66-520MHz, 1.4 and 2.5GHz.

Telemobile's T.D.M.A. Fixed Wireless Access systems offer solutions

for rural
telephony requirements for village CommunityTeleCenters (CTCs) and wireless MultipurposeCommunityTelecenters (MCTs).

We help extend the city telecom service to the rural unserved areas. Oftentimes our installation sites have dirt floors and no electricity!

If you have come across these situations, we should discuss how to work together toward universal access into these rural areas.

Point-to-point wireless PHONELINK® for voice, fax, data available for immediate delivery.
Hablamos espanol. Falamos portugues.

TIME WARNER TELECOM

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TIME WARNER TELECOM
Booth #68

Time Warner Telecom - Hawaii, offers total network solutions that include both Transport services STM1, STM4, DS1 through OC48) and Switch services (ISDN PRI, PBX Trunks) at competitive rates. Transpacific Cable Landing Backhaul service from Southern CrossÕ Kahe Point cable landing is currently available. Longhaul and Backhaul services from Japan-US Makaha cable landing will be available later this year.

Time Warner Telecom/Oceanic Communications customers are ensured clear, reliable service via our redundant, 100% digital, fiber optic ring networks, using state-of-the-art Synchronous Optical NETwork (SONET) architecture.

General Information

- 100% SONET
- Lucent 5ESS Central Office Switch
- CISCO Internet Platform|
- 99.999% network availability

Services Available

- Transport Service (DS1 through OC48)
- Private SONET Rings
- Switched Services (Analog Lines through ISDN PRI)
- Internet Service (DS1, DS3, ATM based burstable service)

- Long Distance Services (Fractional DS1 through full DS3, ATM burstable service)
- InterLATA Private Line Transport (DS1 Ð OC48)
- Ownership interest in Japan Ð US Cable

Local Exchange Carriers Colocations

- Alakea LSO 1177 Bishop Street
- Puuloa LSO 501 Main Street
- Moanalua LSO 3004 Moanalua
- Kailua LSO 282 Kuulei Road
- Punahou LSO 2054 Young Street

Interexchange Carrier POP Colocations

- AT&T
- Sprint
- Long Distance / USA Satellite

Earth Station Connectivity Providing backhaul transport from Southern Cross to various earth stations:

- Kapolei Spaceport
- Sunset Beach Satellite Gateway
- Teleports in Pearl City Industrial Valley

THE INFOCOMMS FORUM

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THE INFOCOMMS FORUM

Booth #104

In recognition of the convergence of information and communications technologies, the INFOCOMMS Forum series was launched at World Telecom '99 in Geneva, beginning with INFOCOMMS Forum Asia Pacific, which widens the coverage of issues beyond telecoms development and liberalisation to include the role that the Internet and wireless technologies play. Other regions that will be covered shortly include Africa, North America, Europe and Middle East.

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Tundra Communications Inc.

Booth #4

Tundra Communications engineers and install wireless telecommunications transport systems. Tundra turnkey entire projects from design to construction. This includes program management, site selection, transmission engineering, material acquisition, systems installation, commissioning, antenna installation and final tower construction. We are well know for ourterrestrial microwave engineering and installation work. Tundra also install and commission satellite earth station systems. Tundra has offices in Alaska, Redmond Washington and Honolulu Hawaii. For more information,visit our website at www.tundracomm.net

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TyCom Ltd.

Booth #43—44

TyCom Ltd. (NYSE: TCM; BSX: TCM), is one of the world's largest providers of advanced broadband communications capacity, systems and services. TyCom is a leading fully integrated supplier of transoceanic fiber optic systems, is the recognized world leader in undersea technology development and application, and operates one of the world's largest fleets of cable ships. To meet growing demand, the Company is also deploying and selling capacity on the TyCom Global Network. TyCom's parent company is Tyco International Ltd. (NYSE: TYC; LSE: TYI; BSX: TYC). For more information on TyCom, visit www.tycomltd.com.

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Verizon Logistics

Booth #91—92

Verizon Logistics is a worldwide provider of telecommunications equipment and logistic services, featuring various products from all the major telecommunications manufacturers and service providers. Verizon Logistics can provide the entire spectrum of logistic services; from vendor selection/management, to procurement, to warehousing and distribution. Verizon Logistics also provides electronic repair services, calibration, metrology and reverse logistics.

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VIA SATELLITE

Booth #25

Via Satellite is the industry's leading magazine, trusted by more than 22,000 decision-makers in over 160 countries around the world including satellite users, operators, broadcasters and investors. The magazine is respected throughout the industry as the leader in global industry coverage, achieved through in-depth monthly features as well as "briefs" on contracts, services, people and technology. Via Satellite provides the leading players in the satellite marketplace with up-to-date information on what's new and what's next as well as the key resources they need to understand and direct the industry's future. Via Satellite also sponsors the SATELLITE 2001 Conference and Exhibition, to be held March 28—30, 2001 in Washington. D.C.

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VIASAT

Booth #33

At PTC, ViaSat will demonstrate how its exclusive Paired Carrier Multiple Access (PCMA) can increase network capacity and make satellite communications economical for more locations and applications. ViaSat Satellite Networks products include fixed and mobile broadband data networks; VSAT networks for retail operations, financial transactions, or other enterprise networking; complete ground station infrastructure for advanced constellations, telemetry, imaging, and connecting to terrestrial networks; and toll-quality voice and fax for areas out of the reach of wired infrastructure.
The company is also becoming the choice for next generation Ka-band systems, including its recent selection as the first terminal supplier for Astrolink ViaSat Satellite Networks is the combination of ViaSat's StarWire DAMA IP products and the Satellite Networking Business formerly owned by Scientific-Atlanta. The combination features a global service organization with the ability to support large or small networks, and respond to customer needs on a daily basis.

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VIDEOPHONEPLUS LTD.

Booth #115
VideoPhonePlus Ltd. Is a new company formed to provide 'dial-up' videoconferencing services by satellite across Asia-Pacific. The company plans to establish a network of VSAT based VideoPhonePlus Central offices (VPCO's) in the Central Business Districts of all large cities in Asia.

Each VPCO will provide a wireless hub to support wireless VideoPhonePlus subscribers within the service area and enable 'industrial strength' videoconference calls to be switched between wireless subscribers in the same city or other cities in the same country or other countries.

VideoPhonePlus will operate a VSAT DAMA satellite hub at the new Hawaiian Islands Teleport in Hawaii. This hub will control video call switching between any two or more VSAT VPCO's. Additionally it will provide a VSAT/ISDN gateway to connect ISDN originating or terminating video calls in the USA, Europe or Australia to the VideoPhonePlus subscribers in Asia-Pacific.

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VISION ACCOMPLISHED HAWAII
Booth #130

Vision Accomplished HAWAII provides satellite uplink and downlink systems plus satellite service coordination for customers throughout Hawaii and the Pacific Rim.

Mobile and Fixed antenna and electronic systems are available to relay data, video and voice information to and from both US Domestic and international satellites.

Founded in 1984 and still privately held, Vision Accomplished Hawaii is part of Hawaii Overseas Teleport Communications, Inc., a Hawaii corporation. The company owns three mobile earth station systems and has antenna systems for fixed services in downtown Honolulu and Kapolei, Hawaii.

For more information about the company or a price quotation for services please contact us at the address below or by phone by visiting our website on the worldwide web at: www.visionaccomplished.com.

Whatever you vision for efficient cost-effective satellite services is, we believe we can accomplish and in many cases exceed your goals.

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VIVE Synergies Inc.

Booth #5

VIVE Synergies Inc. designs, develops, produces, markets, and supports in worldwide markets an extensive line of automated Least Cost Routing dialers and dialing systems, supervised PayPhones and automated systems for Public Telephone Centre or Call Shop operation and a suite of Voice and Fax over IP systems for Internet Fax and Telephony. The company shall continue to create and produce innovations that enhance the productivity of work operations and improve the quality of life where telecommunication is concerned and shall be a major supplier of products and services for effective and efficient personal and business telecommunication. In particular, VIVE shall continue to supply the required products and technologies that help level the playing fields for alternative carriers and service providers operating in newly deregulated telephone industry environment.

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Voiceware Systems

Booth #42

Voiceware™ Systems Inc. manufactures the Telephony Services Platform (TSP)™–a PC & Excel based tandem switch. We have led the way as a turnkey provider of advanced switching platforms for Prepaid Telecom Services Industry. Running on Windows NT, the TSP™ supports Prepaid and Postpaid Calling Cards, Prepaid Wireless, International Resale, Long Distance Resale, ISDN - Intelligent Call Routing, and Billing & Reporting. Enhanced Services include: Voice Mail, Fax Mail, Conference Calling, One Call, Internet Connectivity, VoIP–Voice over Internet Protocol, SS7 Networking, IVR–Interactive Voice Response, IP Agent Gateway, IP Customer Service, Watch Dog, RAID Level 5, Credit Card Recharge, and Custom Scripting Languages.

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WCI Cable

Booth #39

WCI Cable manages and constructs terrestrial and submarine fiber optic systems, including the NorthStar Network, connecting Alaska with the Continental US, and undertakes new network projects around the world. WCI's carrier neutral cable landing station on the Oregon coast provides entrance and egress for US and global Internet bandwidth. Most recent cable landings have been SCCN, FLAG and Tycom. As an Internet2 corporate partner, WCI is working in cooperation with the National Science Foundation for the advancement of applications and network technologies extending the capabilities of the internet. It is the WCI vision to be a provider of wholesale access and transport services across broad regional, national, and international networks, offering differentiated quality and value to our customers. WCI provides global vision, neutral platforms and innovative solutions. WCI Cable is a privately held corporation and a member of the WCI Group of companies.

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WCI Lightpoint

Booth #40

WCI LightPoint was founded to build, maintain and provide state of the art, carrier neutral colocation facilities throughout the US and around the world. Our goal is to provide flexible, secure, customized colocation facilities for our

customers to use in transmitting their mission critical information. As such, we provide fully energized scaleable space and allow customers to lease only the amount of space they need to start, while giving them room to grow in the future. All space is constructed to superior telecom environmental standards including, HVAC, fire suppression, security and access to other carriers. WCI LightPoint is a privately held corporation and a member of the WCI Group of companies.

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WIKI TELECOM
Booth #134

Wiki Data Systems by NextNet

Wiki Data Systems is a complex webhosting and network management service, connecting the Pacific Rim to the world. Thanks to soon to be deployed high end Internet sites in Honolulu, San Diego, Oregon and Guam, Wiki Data Systems will provide state-of-the-art internet solutions for mission critical operations.

The 40,000+ sq. ft. facilities will be NEB-3 compliant, offering fully redundant HVAC systems; one full megawatt of power sitting on two separate grids; plus fully redundant power with battery backup.

Services will include Web Hosting, Co-location, Managed Services, Dedicated Access, Streaming Video, WikiCache and E-Commerce. Customers will be able to choose as many services as they like. Security measures will feature Firewalls, E-Mail Virus Scanning, Virtual Private Network, Content Filtering and URL Blocking.

For more information please contact Art Sprake at 1-866-462-4800. Or email at wikidata@nnventures.com

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Worldcom

Booth #57—58

WorldCom (NASDAQ: WCOM) is a preeminent global communications company for the digital generation, operating in more than 65 countries. Global revenues in 1999 were $36 billion, with $15 billion from high-growth data, Internet and international services. WorldCom provides the innovative technologies and services that are the foundation for business in the 21st century . Visit us during PTC to learn about generation d and how WorldCom is boldly leading the charge into the e-business marketplace. For more information go to http://www.wcom.com

Xdrive℠ technologies

X-drive Technologies
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X-drive Technologies

Booth #105-106

Xdrive Technologies provides infrastructure software and services that enable anywhere, any device, file storage, access and collaboration. The Xdrive platform currently services more than 7 million consumers worldwide. Our proven, scalable solutions meet the large scale demands of carriers and their customers. Leveraging the power of our technology, carriers can increase revenue, reduce customer churn, and enhance customer communications. Extend your reach with Xdrive Technologies

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- **Complete Attendees List**
- **Download Attendees List in Microsoft Excel**

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